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ABSTRACT

A needs assessment survey was made to analyze the needs and attitudes of parents and educators in regard to the metric system. Questionnaires were sent to educators, K-5, and to parents of 10 randomly selected classrooms in 2 Illinois school districts; one an urban area and the other a farming community. The 549 returned questionnaires were analyzed by inferential and descriptive statistics. Parent needs and attitudes in regard to the metric system were directly related to communities and education. No such relationships were found for educators. The study showed that although parents and educators generally were negative toward the metric system, they recognized the need of children and the American worker to learn the metric system, and felt all the educational resources in the United States must contribute to the education of the entire population to change over to the metric system. (MP)

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# A COMPARATIVE STUDY OF NEEDS AND ATTITUDES OF PARENTS AND EDUCATORS IN REGARD TO THE METRIC SYSTEM

Betty Lou Whitted

SE 027 977

ABSTRACT

# A COMPARATIVE STUDY OF NEEDS AND ATTITUDES OF PARENTS AND EDUCATORS IN REGARD TO THE METRIC SYSTEM

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A Dissertation Submitted in Partial Fulfillment of
The Requirements for the Degree of
Doctor of Philosophy

WALDEN UNIVERSITY
April 1979

A needs assessment survey was made to analyze the needs and attitudes of parents and educators in regard to the metric system.

Eight research questions were stated:

1. What are the educational needs of parents to reach literacy in the metric system?

2. What are the educational needs of educators to reach competency in the metric system?

3. What are the attitudes of parents toward metrication?

4. What are the attitudes of educators toward metrication?

5. What is the greatest problem envisioned by parents regarding metrication?

6. What is the greatest problem envisioned by educators regarding metrication?

7. To what degree would parents and/or educators attend workshops, read, and so forth to gain more knowledge in the metric system?

8. Does age, education, or community have any influence on knowledge and/or attitude of parents and/or educators?

A questionnaire was devised and seven hundred fifteen were sent to educators, K-5, and to parents of ten randomly selected classrooms in two Illinois school districts; one, an urban area and the other, a farming community. Five hundred forty-nine questionnaires were returned.

These were analyzed by inferential and descriptive computerized statistical programs. The inferential study, using the Chi Square, analyzed the relationship of age, education, and community to each of the research questions.

The Chi Square showed that in the cases of parents; communities, in all cases, and education in some, directly related to parent needs and attitudes in regard to the metric system.

The Chi Square analysis showed no such relationship for educators.

The descriptive study observed frequencies. These showed that although parents and educators generally were negative toward the metric system, they recognized the need of children and the American worker to learn the metric system, and felt all the educational resources in the United States must contribute to the education of the entire population to change over to the metric system.

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Gone is the mile of measured length
   And pint and pound and peck;
Gone the gilbert of magnetic strength,
   The dram no more correct.

And though the inch-worm does not change
   As the inch is banished,
Won't the earth seem wondrous strange
   Now the foot has vanished?

Gilbert

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# I. INTRODUCTION

## Background of Problem

Since the time of President Washington, the United States has wrestled with the problem of whether or not the metric system should be adopted as its official system of measurement. The issue has been raised throughout the history of the United States, and in 1886 Congress actually passed legislation making the metric system the official system of measurement. Since Congress made no provisions for its implementation however, this law has had very little effect.

During the "Sputnik era" and at the beginning of international technology, the issue was again considered by Congress. After a decade of discussion, President Johnson signed a bill in 1968 to study implementation of the metric system throughout the United States. This study resulted in President Ford's signing two bills in December 1975, which provided that "the policy of the United States shall be to coordinate and plan the increasing use of. . .and voluntary conversion to the metric system."[1] This conversion was to be spread over a period of ten years.

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[1] Dennis R. Smith. "Role of the Metric Board in Education," U.S. Metric Association Newsletter 13, no.2 (May 1978), p.3.

Kresse stated that while the rest of the world converted to the International System of Units (SI), Great Britain and the United States continued using the customary measuring system with the thought that the world would eventually succumb to the material growth and superiority of the Anglo-Saxon nations and change to their Imperial measuring system.[1] As the new major industrial nations emerged, specifically Germany, Russia, and Japan, Great Britain and the United States found themselves challenged economically. This resulted in Great Britain's instituting a ten-year program for conversion to the metric system from 1965-1975, and the United States, as stated, finally planning a ten-year program which began in 1975. During an interview, Hodgkinson stated that Great Britain is still involved in this conversion and the completion date is unknown at this time.[2]

Problem

As with all major changes, especially one so deeply entrenched in the daily lives of the American people, there has been great resistance to changing the American measuring system.

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[1] Richard S. Kreese. "The Controversy over Metrication in the United States," Graduate Research in Education and Relation Design, (Sept.-Oct. 1974), p. 23.

[2] Harold Hodgkinson, interview with the writer, held in July 1978.

Industry in the United States recognizes the need for the change to the metric system if it is to compete on the world market. Industrialists are slowly converting their products to the metric system.

Government, recognizing the need to increase the Gross National Product, is encouraging this change and through its Department of Health, Education, and Welfare, is encouraging schools to effect this change.

Schools, bowing to state and federal pressure, are requiring the change in the classrooms that the metric system be the only system taught.

Metrication is now being imposed on the American people because of economic necessity.

This survey studied the needs of and attitudes toward the metric system by parents and educators; educators, because they are having to teach this system, and parents, because they are indirectly involved in metrics in their daily life and do not understand the change.

The problem arises with people not directly involved in this conversion - the so called "common man" who does not understand the need for this conversion or the reason why such a question should even be posed. The present measuring system is adequate for them. It has served their parents, grandparents, as well as themselves all through the years. Why then the change?

Parents are questioning teachers about this change. They find they are again in the position of having their children learn something, (especially those in the elementary schools), which they do not know or understand. They are unable to discuss metrics with their children or help them with their learning.

Educators, realizing the magnitude of this problem, are actively encouraging metrication, through school and community participation. Virtually a whole math strand (measurement) in the curriculum will be shortened since the metric system is a decimal system and can be easily learned. Some educators are aware that children graduating from our schools will be required to know the metric system, and that adults must be educated to their immediate needs, especially as consumers. This task is being accepted by them and is being met in some school communities. Others, however, still resist the change and remain uninformed. Many more schools will have to set up programs to meet the needs of educators and parents, as well as the needs of students.

Because government, state boards of education, and industry have requested that metrication be implemented, and because parents and some educators have exhibited a high level of resistence which has caused both of them great anxiety, the writer felt it is important that this study be made. The educational needs of parents and

and educators must be determined so that they, and their children, may receive the necessary education to effect metrication easily.

Definition of Terms

Terms used in this paper are defined as follows:

Metric System. A decimal system of weights and measures based on the meter as a standard of length and the kilogram as a standard of mass (weight).

International System of Units (SI). The metric system as it is now understood, redefined and revised as a universal measuring system, hereafter referred to as the metric system.

Metrication. A word coined in Great Britain and adopted by authorities to mean conversion to the metric system.

Metric Literacy. The ability to understand and use simple everyday metric measures to exist in today's society.

Metric Competency. The ability to understand, use, and teach the metric system - to "Think Metric."

Soft conversion. A term used in industry meaning the kind of conversion the American public is experiencing at this time. This simply changes the numbers on drawings or containers from customary to metric units; i.e., highway signs, weather reports, food packaging and so forth.

Hard conversion. A term used in industry meaning the change to metric standards. It probably requires the purchase of tools. Hard conversion is usually planned over a period of time.[1]

## Purpose of the Study

The identified need for metrication brings about the purpose of this study:

1. What are the attitudes of parents and educators toward metrication? Knowing these attitudes and the amount of resistance that exists can help government, industry, and educators institute programs that will reduce resistance and help educators and parents learn and use the metric system.

2. What are the educational needs, if any, of parents and educators in the metric system? Knowing these needs can lead to programs that will bring parents to a literacy level and educators to a competency level in the metric system.

Hopefully, this study will bring about programs that will lead both parents and educators to eventually "Think Metric."

## Plan of Presentation

This study involved a survey of parents and educators in two selected Illinois School Districts to determine their attitudes about and educational needs to reach the literacy and/or competency levels in the metric system. These school districts were selected because they typically represent both urban and rural districts. One school district, in a city of about 50,000, is in the center of a large metropolitan area of around three hundred thousand population. The area includes Davenport, Iowa, Rock Island and Moline, Illinois, as well as numerous smaller surrounding communities.

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[1] Roger W. Berger, "Inching Into SI," Engineering Education, 67 (April, 1977) 689.

The second district is a farming community of approximately fifteen hundred population. This town, situated near a large interstate highway, is in the process of becoming a "bedroom" community for the Tri-City area, named above, which is thirty miles away. Today, however, it is a small rural community.

One of the questions raised by this study is concerned with influence, if any, of the community on the metric knowledge and attitudes of the population tested. Also considered, is the influence of age and education on knowledge and attitudes of the population.

A questionnaire was devised and a pilot study of the questionnaire was made. Seven parents and thirteen educators outside the selected population were surveyed. This study showed that no individual question on the questionnaire presented a problem of intelligibility and that it communicated clearly. The instrument was then printed.

The questionnaire was sent to randomly selected parents and to school personnel to determine their needs during the period of metrication. The questionnaire reflected their attitudes and measured their current knowledge of metrics. It also examined problems envisioned, degree to which people would participate in further education, and the possible influence of age, education, and community on the knowledge and attitude of the persons surveyed. Four hundred fifty-seven parents and two hundred fifty-eight educators were surveyed.

## Research Questions

This study focused on eight research questions:

1. What are the educational needs of parents to reach literacy in the metric system?

2. What are the educational needs of educators to reach competency in the metric system?

3. What are the attitudes of parents toward metrication?

4. What are the attitudes of educators toward metrication?

5. What is the greatest problem envisioned by parents regarding metrication?

6. What is the greatest problem envisioned by educators regarding metrication?

7. To what degree would parents and/or educators attend workshops, read, and so forth to gain more knowledge in the metric system?

8. Does age, education, or community have any influence on knowledge and/or attitude of parents and/or educators?

Limitations

A limitation of the methodology, as seen by the researcher, is that possibly not enough items were asked to really measure the literacy level of parents and the competency level of educators. It was felt that too many items would have discouraged parents and teachers from answering the questionnaire and resulted in poor returns. However, the researcher believes that enough items were covered to show a trend from which some valid conclusions could be drawn.

Significance of the Study

This study is of significance to the State of Illinois Department of Education, the local school districts involved, as well as the surrounding school districts in both the States of Illinois and Iowa. It is also of significance to industry in the Tri-City area where one school district is located. Three of the largest international farm implement plants have their home plants or large plants in this area. Because of the fact that all of these companies are international, they are in some stage of metrication at the time of this study. This study should be of help to these industries to see the need, if any, for further adult education for their employees via television, workshops, conferences, and so forth.

## Assumptions of the Study

Ideally, a diffusion of change is time ordered and seeps into a lifestyle gradually. Economically, the United States does not have that kind of time. Ten years is too long for industry to wait for metrication.

Workers are finding it necessary to operate now in both systems. If they used only one, they would become more efficient.

Children graduating from our schools will move into a metric world for which they should be educated.

Metrics are now being introduced to the public through various media: television weather shows, highway signs, dress patterns, canned goods and beverages, to name a few. All of these either state metrics on the signs, packages, or, as in beverages, are in metrics only.

Whether or not the United States successfully implements the metric system within the proposed ten-year period, all its peoples will in one way or another be confronted with metrication, either as a consumer, farmer (metric tons), factory worker, or other. These people will have to be taught at least the basics of the metric system to survive in society.

## Summary

Historically the United States has been legally free to adopt the metric system for more than a hundred years. Legislation was passed in 1866 making the metric system legal; however, implementation of the system was not included in the bill. In 1975 legislation was passed allowing a ten-year period for implementation of the metric system to be accomplished.

Economic reasons are now forcing implementation of the metric system. Government, industry, and education are leading a movement toward metrication.

This study was a needs assessment survey, with a questionnaire being sent to selected parents and educators, to determine their attitudes and literacy and/or competency levels in the metric system. It examined variables of knowledge, perceived educational needs, problems envisioned, attitudes toward metrication, degree to which people would participate in further education, and the possible influence of age, education, or community on the knowledge and attitude of the persons surveyed.

The limitations were that possibly not enough items were contained in the questionnaire to measure the literacy level of parents and the competency levels of educators in the metric system.

The study is of significance to leaders in education and industry in both the States of Illinois and Iowa.

Metrication, the changing of a deeply rooted measuring system already in common use to a new system of measurement, has caused a great deal of anxiety and resistance to the American people because they believe it is being imposed on them. This study should in the long run aid in lowering this level of anxiety by lowering resistance to the metric system. The questionnaire itself, and its findings could show people their needs, if any, for further adult education via television, workshops, handbooks and so forth; and possibly, be the instrument whereby more adult education is implemented.

## II. REVIEW OF RELATED LITERATURE

While this research is involved in studying attitudes toward, and knowledge of the metric system by parents and educators, significant insight can be obtained from a review of the related literature.

### Outline of the Review

This review has been divided into several sub-headings: History, Foreign Countries, Education, Industry, Resistance, and Summary.

### History

Probably no other issue in the United States has caused such controversy for so long a time as has the problem of the metric system and metrication.

Thomas Jefferson and Robert Morris first submitted a decimal plan to the Continental Congress for coinage and measurement in 1786. The coinage part of this bill was enacted in 1792, however, little attention was given to the measurement segment. In 1790 George Washington reaffirmed the need for a uniform weights and measurement act. In 1799 the first Weights and Measures Act was enacted, and was known as the "Surveyor's Act." This act ordered an annual examination of the weights, measures, and instruments used in assessing customs duties.

France, in the meantime, issued a decree officially adopting the metric system. In 1798, Kresse states, Tallyrand, France's Minister of Foreign Affairs, reaffirmed France's leadership in the scientific community and solified and international status of the metric system by calling an international meeting to review and work on standards.[1] Danloux-Dumesnils stated that nine countries sent delegates to this meeting. In view of the difficulties between England and France at that time, the United States was unwilling to take part. In 1812 Napoleon Bonaparte temporarily suspended the metric law as compulsary and restored and pre-Revolutionary unit names for French weights and measures.[2]

Spurred on by a 1916 presidential address by James Madison, a new committee was selected to reconsider adoption of Jefferson's decimal measurements. In 1821, Secretary of State, John Quincy Adams, submitted an exhaustive report to Congress in which he recommended retention of the customary system. Adams spoke glowingly in his report of the desirability and advantages of a universal system of weights and measures. However, he recognized the futility of attempting to implement any new system which was foreign to American usage.[1] His defense of the customary system is a classic argument in the annals of metric history:

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[1] Kresse. "Controversy", p. 23.

[2] Maurice Danloux-Dumesnils. The Metric System, a Critical Study of its Principles and Practice, (U. of London: Athlone Press, 1969) p.3.

> Weights and measures may be ranked among the necessaries of life to every individual of human society. They enter into the economical arrangements and daily concerns of every family. They are necessary to every occupation of human industry; to the distribution and security of every species of property; to every transaction of trade and commerce; to the labors of the husbandman; to the ingenuity of the artificer; to the studies of the philosopher; to the researches of the antiquarian, to the navigation of the mariner, and the marches of the soldier; to all the exchanges of peace, and all the operations of war. The knowledge of them, as is established use, is among the firstelements of education, and is often learned by those who learn nothing else, not even to read and write. This knowledge is revited in the memory by the habitual application of it to the employments of men throughout life.[2]

This researcher has found no better description of the depths of measurement in human life.

Congress felt no action was needed on Adams' report, but in 1832 the Secretary of Treasury adopted the avoirdupois pound and the Winchester bushel to be the official system of weights and measurements to be used in the U.S. custom houses. This was enacted when it was found that there was little uniformity between the different custom houses. It is interesting to note that weights and measurements are traditionally set by governments in order to levy taxes on trade. This declaration was passed by Congress in 1836 and by 1856 a set of standards was supplied to all states and territories. This was the first evidence of uniformity throughout the country.

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[1] Ronald Edward Zupko. "The Long Ordeal: The Metric Changeover in the U.S." Intellect, 104 (Sept./Oct. 1976) p. 116.

[2] Kreese. "Controversy," pp. 267-268.

At about the same time, 1837, a law was passed by the French government reinstating the metric system effective January 1840.

However, even as the world moved with increasing speed toward the Industrial Revolution, America kept a close trade relationship with Great Britain and did not feel any great need for extension of that trade. In 1863 President Lincoln formed the National Academy of Science to advise the goverment on technical matters, and one of its first considerations, was to establish a committee to study the metric system.

After two years of investigating, the Academy recommended adoption of the metric system and in 1866 Congress passed a law in essence stating that

> It shall be lawful throughout the United States of America to employ the weights and measures of the metric system, and no contract or dealing or pleading in any court shall be deemed invalid or liable to objection because the weights and measures referred to therein are the weights and measures of the metric system.[1]

> Since the United States Constitution specifically assigned to Congress the responsibility to "fix the standards of weights and measures," and since Congress has never endorsed the customary system, we are left with the delightful conclusion that the metric system is the only legal measurement system in the United States![2]

Although this law made the metric system the law of the land, it made no provisions for implementation.

Frederich A.P. Bernard, President of Columbia University, lead a movement to secure widespread adoption and voluntary use of the metric system by educating a "rising generation." Professor Davis and Regent Hale, also of Columbia, considered this question and submitted a report almost totally unfavorable to further action regarding the metric system. This was the first anti-metric work to appear in print. This report was a trend setter of arguments against the metric system.

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[1] Roger W. Berger. "Inching Into SI", Engineering Education, 67, (April 1977), p. 689.

[2] Ibid., p. 689.

Kreese told us that this report stated in part that Americans would not voluntarily change; they shouldn't change until the U.S. was sure the rest of the world would, and as yet, metrication was not too successful in countries where it had been adopted; metrics came from a foreign country - and the French themselves resisted the adoption; every measurement in the country would have to be re-established.[1]

In 1872, Bernard issued a pro-metric refutation of Professor Davis' report and that of John Q. Adams', Bernard cited economic need of the world to cooperate. Public acceptance was his goal and the goal of proponents to come after him. Bernard established the American Metrological Society in New York to work for universal adoption of a standardized system - preferably the metric system.[2]

The Treaty of the Metre was signed by seventeen countries in Paris in 1875 and the United States ratified it in 1878 under President Hayes. This treaty set new and improved standards for the metric system and established an International Committee on Weights and Measures to be headquartered in Paris, and under this Committee, the

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[1] Kreese. "Controversy," pp. 38-39.

[2] Ibid., pp. 40-41.

International Bureau of Weights and Measures with the responsibility of setting up metric standards. Forty-two nations have signed this treaty.[1]

Everyone did not agree, however, that metrics should be adopted. Charles Latimer was outspoken against the metric system and published a denunciation in a book titled "The French Metric System, or the Battle of the Standards." Charles A. Totten also wrote in opposition in a book titled, "An Important Question in Metrology: A Challenge to the Metric System." Totten favored an international system, but thought the Anglo-Saxons could perfect one of their own.[2]

Religion was involved with metrology until the end of the nineteenth and early twentieth centuries. The French who devised the metric system were viewed as athiests. The theory among some anti-metric people was that the Anglo-Saxon weights and measures were Divinely ordered and to tamper with them would be sacrilegious. The cubit related to God giving it to Noah to build his Arc.[3]

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[1] Kreese. "Controversy", p. 40.

[2] Ibid., pp. 40-41

[3] Frank Donovan. Prepare Now for a Metric Future (New York: Weibright and Talley, 1970), p.85.

One American religious journal read in part:

> This system came out of the Bottomless Pit. At that time and in the place whence this system sprang it was hell on earth. The people defied the God who made them; they worshipped the Goddess of Reason. In their made fanaticism they brought forth monster. . .unclean things. Can you, the children of the Pilgrim Fathers, worship at such a shrine, and force upon your brethren the untimely monster of such an age and place?

Deming tells us that this writer was registering an objection to the metric system![1]

About this time, a song was published in the International Standard entitled "A Pint's A Pound the World Around." Following are two of its five stanzas and the chorus:

> They bid us change the ancient names',
> The 'seasons' and the 'times'
> And for our measures go abroad
> To strange and distant climes.
> But we'll abide by things long dear,
> And cling to things of yore.
> For the Anglo-Saxon race shall rule
> The earth from shore to shore.
>
> Then down with every 'metric' scheme
> Taught by the foreign school
> We'll worship still our Father's God
> And keep our Father's "rule."
> A perfect inch, a perfect pint,
> The Anglo's honest pound
> Shall hold their place upon the earth,
> Till Time's last trump shall sound.

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[1] Frank Donovan. Prepare Now for a Metric Future (New York: Weibright and Talley, 1970), p.82.

Then swell the chorus heartily,
Let every Saxon sing:
"A pint's a pound the world around,'
Till all the earth shall ring.
"A pint's a pound the world around'
For rich and poor the same;
Just measure and a perfect weight
Called by their ancient name![1]

Latimer, in the meantime, established the International Institute for Preserving and Perfecting Weights and Measures which was the culmination of the religious defense of Anglo-Saxon units in the late 1800's.

The flare-ups in the controversy to the metric system have paralleled Congressional interest in the issue. A bill by Congressman Southard of Ohio was introduced in 1902 requiring all government departments to use the metric system exclusively. This bill was sure to pass. Even the New York Times, who was opposed to the bill, admitted that it would certainly pass. Just as it was about to be considered, Congress adjourned. It was at this time that Frederich A. Halsey, editor of the "American Machinist" and Samuel Dale co-authored a book, The Metric Fallacy. This book was to become the 'Bible' of anti-metric people for two generations to come. The book contained arguments against the metric system and also carried in its extended appendix the feelings of important 'big business' and government people in 1904. Conclusions drawn by Halsey from 'big businessmen' were, ". . . that the commerce of the world is conducted by the English system, and that the 'international metric system' is nothing but a pretex and a sham." He further reported that eighty-two of the exporters to metric countries surveyed use metrics not at all in production.[1]

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[1] Richard Deming. Metric Power (New York: Thomas Nelson Inc., 1974), p. 85.

Halsey and Dale organized the American Institute of Weights and Measures which was the most down-to-earth, and therefore most effective anti-metric group ever formed.

When Southard's bill was re-introduced in Congress in 1906, Alexander Graham Bell gave a lengthly dissertation on the merits of the metric system. He completely converted his laboratory to metric. Bell stated:

> The result may be of interest to the committee as bearing upon the question of the ability of the common people of America to handle a new system of this kind. No difficulty whatever was experienced in the use of the system, and the total expense involved in the change amounted to a few dollars for the purchase

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[1] Frederich A. Halsey, Samuel Dale. Metric Fallacy (New York: American Institution of Weights and Measures, 1919 - 2d ed.) p. 165.

> of a set of metrical weights and measures. The same balances formerly employed were equally efficient in weighing by the metrical system and even the old weights were utilized as supplementary weights, with their value in grams distinctly marked upon them. No change was required in the machinery and tools employed, simply a change in the method of measuring the output.

Bell also claimed the problem of retraining his workmen was negligible.

> All the difficulties in the metric system are in translating from one system to the other, but the moment you use the metric system alone, there is no difficulty. The workmen in my laboratory used the metrical weights and measures right off. I did not ask them to translate from one system to the other, for that would speedily have developed their limitations of education. I simply asked them to use the metric system, and they did it without difficulty. They now use meters and centimeters and grams and kilograms as if to the manner born, and they are simply common carpenters and mechanics. I consider them as an average sample of the common people. I do not anticipate any difficulty in the use of the metric system by itself.

As to costs, Bell stated:

> I think the difficulty has been unduly magnified. The fact is that the change does not necessarily involve any change in tools or machinery at all - or at least not to any great extent. It is a question of arithmetic, not of tools or machinery. You can measure the work or output of the present tools or machinery just as well by the metric system as in the ordinary way. . .it is only where very fine and accurate measurements are required that special tools would be needed.[1]

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[1] Donovan. Prepare Now, pp.93-94

However, under the attack and personal charges by Halsey and his followers, Southard withdrew his bill. In 1918, the War Department provided for the use of the metric system for wartime activities. The World Trade Club, a group of distinguished businessmen, launched a pro-metric campaign. This was effectively countered, however, by a second and revised edition (1919) of Halsey's, The Metric Fallacy. With the onset of the Great Depression, lack of money caused funds to be unavailable, and the issue was laid to rest for the time. In 1931 the World Trade Club had folded and the American Institute of Weights and Measures had disappeared.

The first bill on the metric system to be considered by Congress since 1902 was in 1937. Although this bill was not enacted, it was an important step in metric history. The 1948 Twentieth Yearbook of the National Council of Teachers of Mathematics was given solely to the discussion of the needs and advantages of using the metric system.

A significant move toward metrication came when the world was propelled into the space age - "Sputnik" had arrived. The development of the European Common Market of metric nations had the effect of economically isolating Great Britain and the United States.

In 1960 at the eleventh General Council of Weights and Measures in Paris, the International System of Units (SI) was adopted. This was the new international standard of weights and measures based on the metric system.

Great Britain took the initiative and in 1965 Parliament adopted a planned metric program with a ten-year deadline. "The action by the British has effectively left the U.S. as an island in the metric world."[1]

A series of metric bills were considered, but none were acted upon until President Johnson in 1968 signed into law the bill which established a Metric Board to make "a study to determine the impact of increasing world wide use of the metric system in the United States."[2]

This brought about the U.S. Metric Study headed by DeSimone for the National Bureau of Standards. This extensive study investigated the impact of metrication on ten facets of the American economy. The areas investigated were: Department of Defense and Engineering Standards, Non-Manufacturing Business, Education, The Consumer,

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[1] D.V.DeSimone. A Metric America: A Decision Whose Time Has Come: U.S. Metric Study, (Washington, D.C.; U.S. Government Printing Office, 1971), p. 250.

[2] Zupko. "Ordeal", p. 116.

International Trade, Manufacturing Industry, Commercial Weights and Measures, Federal Government Civilian Agencies and International Standards. Groups responding to this study included 674,000 firms and 19,600,000 individuals.[1]

One of the conclusions of this survey was:

> Irrespective of the eventual outcome of the present study, then, the question of U.S. use of the metric system will have received a more thorough discussion in the years since 1959 than ever before in our history, and more people will have been involved in the eventual decision than at any other time. For this reason, if for no other, future historians will doubtless record these years as another major period in the history of the metric system in the U.S.[2]

As a result of the survey, the Metric Conversions Act (Public Law 94-168) was passed in 1975 by Congress and signed into law by President Ford. This act provides that "The policy of the U.S. shall be to coordinate and plan the increasing use of. . .and voluntary conversion to the metric system."[3] This law requested Congress to create a coordinating body responsible to all sectors of our society, and within this framework detailed plans should be worked out by these sectors themselves. They should establish a target date of ten years ahead, by which time the U.S. will become more predominately metric.[1]

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[1] Technical News Bulletin." U.S. Department of Commerce, National Bureauof Standards, (Washington, D.C., U.S. Government Printing Office, 1971), p. 230.

[2] De Simmone. Metric Study, p. 253.

[3] Smith. Role of Board, p.3.

Berger stated that based on the provisions of the law, and the experiences of other countries, we can predict the shape of our changeover. He predicts: metrication will remain voluntary and will take about ten years; the country will see some confusion similar to the confusion over the Monday holidays legislated by Congress; subsidies will be a large issue, the costs must fall where they may, and government will not subsidize business for costs of conversions; Congress has established a twenty-five person Metric Board (National Metric Conversion Board), and this board will be an on-going coordinator of change for various sectors; the 'rule of reason' will prevail. In short this means there will be no conversion unless, and until, benefits outweigh the disadvantages.[2]

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[1] Zupko. "Ordeal", p. 116.

[2] Berger. "Inching", pp. 690-691.

## Foreign Countries

In discussing this change, not only is it feasible to look to the past to see how best the future can be predicted, but it is also important to look at other countries who have experienced these same problems, to see how they coped with metrication. England, Australia, and Canada have been involved in metrication for various periods over the past thirteen years.

Great Britain started in 1965 with a voluntary program which counted heavily on schools taking the lead to make the change smooth and lasting. Today, thirteen years later, Great Britain is still having problems in that the children learned metric with little or no problems, but lack of public involvement led to general apprehension on the part of adults. It was not that adults persistently resisted metrication, but rather they had not been informed. Lack of the British government fixing firm schedules and informing the public was almost universally cited by the other commonwealth countries as the major problem in Britain.[1]

Australia, profiting from Great Britain's mistakes, has put emphasis on a high level of communication with the general public. Typical of their public education,

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[1] Albert B. Chalupsky, et. a... "An Analysis of Experiences in Five Nationa and their Implications for U.S. Educational Planning." Final Report (Palo Alto, Calif.: American Inst. for Research in the Beh. Sci. 1974), p. 112.

Australia took one month for people to "Think Metric" while driving. They also have had a series of M days, each day geared to metrication of some sector of the economy. Principals of schools in Australia stated they have been frequently asked to explain rudiments of the metric system to parents so they could help their children. The relatively smooth Australian experience with metrication has been due largely to their policy of having those who will have the responsibility of implementation working out the problems.[1]

Thompson stated that Canada is the country to follow. Here schools are comfortably into metrication, bread is bought by the Kilogram, highway signs are in kilometers, and temperatures are given in degrees Celsius. Planning and public information are mainly responsible for this conversion which started six years ago when in 1971 Canada established a Metric Commission to plan and coordinate the change.[2]

In 1973 three areas of concern were noted in Canada: elderly would fearmetrication because it was "hard"; the housewife would feel she is being cheated because metrication would be used as an excuse to raise prices; parents who are just recovering from the

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[1] Chalupsky. "Analysis," p. 113.

[2] Marjorie Thompson, "Metrics: There's No U.S. 'mandate' to switch, but if you don't, you soon may be swimming upstream." American School Board Journal, (Oct. 1974), p. 43.

"Modern Math" would feel another generation gap between what they know and what is being taught to their children.[1]

However, Canada met these challenges and there does not seem to be a gap between school children learning metrics and the real world. By 1980 Canada expects every teacher at every level to be trained in metrics and every class in every school to be using the metric system.

Chalupsky in his 1978 study of the Canadian experience stated:

> The four-phase program of Investigation, Planning, Scheduling, and Implementation, supported by well thought out national and provincial plans, is providing Canada with an exceptionally detailed means of planning for, and measuring the progress toward, its goal of nationwide adoption of the metric system.
>
> While no government program is ever perfect, Canada's carefully planned sequence of metric conversion events in areas of high public visibility presents an excellent example of public education and involvement. Leaders in the U.S. can learn much by studying the progress, as well as the problems, of Canadian metric conversion.[2]

Allen, known as "Mr. Metrics" in Canada, describes metric conversion as: "Government coordinates, but people do it voluntarily. We teachers do it out of enlightened self-interest--and in the interest of the communities we serve and the generation of children we now teach."[1]

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[1] Chalupsky. "Analysis", p. 114.

[2] Albert B. Chalupsky, et. al.. "The Canadian Experience: Implications for Metric Conversion in Education" (Palo Alto, Calif: Amer. Inst. for Research 1978), p. 99.

Education

In looking at the countries presented, schools have had to expand their roles in the community and to assume far greater responsibilities for education. Metrication in the United States offers similar challenges. Schools will be called upon not only to serve their own students, but also parent groups and other adult organizations. Students will also have the equally important role of assisting their elders. There is no doubt that schools will play a major role in this conversion to the metric system.

Chalupsky told us that "If metric education in the United States is ever to reach the stage that is present today in Canada, there needs to be clear evidence of this commitment from the federal government and the United States Metric Board, as well as from the state and local governments. Educators need to be part of a national team, not the only players on the field."[2]

Educational aughorities, national, state and local have recognized the importance of education in the changeover. In 1974 a group of educators joined together to study metrication. They recommended that the United States adopt SI units by 1980 in all schools as a primary way to teach metrics. To be noted, this meeting took place one year before President Ford signed the 1975 metrication bills. California led the way and in 1976 legislated that metrics be the predominent system of measurement in its schools.

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[1] Thompson. "Mandate," p. 43.

[2] Chalupsky. "Canadian Experience," p. 100.

The educational community is concerned because they realize they must prepare people to adequately work and function in industrial, commercial, and consumer sectors. This, they know, must be done whether the United States converts to the metric with a formal policy or not.

Odom stated, "There is no question that these students starting school this year (1973) will be graduating into a metric world. If they don't adequately learn metrics, they certainly will be ill equipped for the world they will inherit."[1]

In the testimony of nationally representative groups to the "Metric Survey" conducted by DeSimone, in 1971, it was observed that experience in teaching the metric system shows it is easier to learn and teach than the customary system. Problems like teacher re-training and textbook conversion would appear, but these problems were thought to be minor compared to the advantages which would be realized.[1]

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[1] J. V. Odom. "The Metric System, Learn It! Think It! Teach It!" Instructor, 83, Oct. 1973.

Chalupsky quoted from the Mathematical Association's recent booklet, "Introduction of SI Units in Schools";

> . . .The formal techniques for multiplication and dividion of fractions no longer have a place in primary schools. If they are needed in the secondary school, they will be learned there, when children are old enough to deal more easily with numbers in the abstract.[2]

Chalupsky in his June 1978 report further stated, "Metric conversion presents an ideal opportunity to evaluate and overhaul the entire program of measurement instruction."

> Educators are in agreement that the traditional program of teaching measurement has been a major weakness in mathematics education. Conversion to the metric system provides the opportunity to rethink the entire measurement program and bring it in line with what is known about the cognitive development of children. New measurement programs in Canadian schools are relying heavily on student activities using manipulative materials; estimation has become a vital part of the program.
>
> Reflecting the fact that SI is decimal in nature, many Canadian schools are increasing their emphasis on decimals, especially in the early grades. It appears that decimals can be introduced effectively as early as grade 3, with formal operations beginning then or in grade 4. Along with this emphasis on decimals, the time spent on operations with fractions will very likely decrease; simple

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[1] D. V. DeSimone. "Testimony of National Representatives," U.S. Metric Study, (Washington, D.C.: U.S. Government Printing Office, 1971), p. 2.

[2] Chalupsky. "Analysis," p. 116.

> fractions will still be taught in the early grades but the manipulation of fractions may well be postponed to grades 7-8.[1]

In a survey prepared by Hawking and Thompson in 1976, it was found that eleven states had set requirements for metric education and developed plans for implementation; twenty-eight states had encouraged uses of SI in their schools and have offered resources and materials to aid schools; eleven states had no provisions for adoption of the metric system, or made no reply to the survey.[1] At the time of this study, two years later, all states have some definite plan for metrication.[2]

The U.S. Office of Education has appropriated and issued two million dollars worth of grants for each of the fiscal years 1973 and ending July 1, 1978. These monies went to such organizations as American Institute for Research in California, The Northeast Metric Research Center in Massachusettes, and the Western Consortium in California. State and regional agencies, as well as local agencies have also received funding.[3]

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[1] "Measuring Metric Education in Public Schools." Engineering Education 67 (April 1977), p. 674.

[2] Thompson, "Mandate," p. 43.

[3] Smith. "Role of Board," p. 3.

Trent conducted surveys starting in 1975 in the State of Nevada. He assessed teacher needs and knowledge in the metric system and found that elementary teachers were more aware of legislation regarding the metric system and the need for teaching it, but they were the least equipped to teach SI units.[1]

It is possible that elementary teachers remember the sixties when "Modern Math" swept the country on the heels of "Sputnik." They were asked to teach what they had not been taught. They did not understand why the math programs were changing. "Modern Math" meant different things to different people. Teachers felt they could not teach something they had so little knowledge of, but textbooks, jumping on the bandwagon and demands of scientists and mathematicians caused a great change in the curriculum. Many pupils were penalized mathematically during this period.[2]

The math pendulum is back in balance and teachers now interpret "Modern Math" to mean finding better and more meaningful ways of teaching math for a better understanding of it. Back into the elementary textbooks are the necessary rote learning pages which were eliminated during the "Modern Math" boom. It is recognized also that all students will not be mathematicians and the problem in teaching is to be selective. The question is not asked what mathematics can you teach, but what mathematics ought you teach. This was a lesson well learned and benefits can be derived from remembering it.

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[1] John H. Trent. Comparative Needs of Elementary and Secondary In-Service Teachers and College Pre-Service Students for Metric Education. (California: ERIC Document Reproduction Service, Ed 115 480, 1975).

[2] Mildred M. Dominy. "Metrics A LaCarte", Metric Talks (Chicago: American Technological Society, 1975), pp. 21-22.

To formulate a change as important as the metric system, not only should the subject be considered (as it solely was in "Modern Math"), but the student needs, and the society in which he lives should have equal importance.

Since California took the lead in metric education in their schools, textbook companies have immediately implemented metric content. Smith stated:

> ". . .some of them going one hundred percent metric. In the 1978 copyright editions of the Harcourt and Silver Burdette math texts the words "feet" and"pound" are barely mentioned. The other publishers, including Holt and Scott Foresman, have increased their metric usage, but to a lesser extent. Thus, our school systems in choosing their new math texts will have little choice but to buy texts that give much greater emphasis to metrics. Unfortunately, some publishers are "going metric" with obviously limited knowledge of SI."[1]

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[1] Smith. "Role of Board," p. 3.

Already, we are starting on the "Modern Math" cycle; state decree and textbooks. Therefore some observations by Dominy should be heeded. Dominy states that it is vital that educators do something now: that plans be made for a gradual non-threatening transition; that the adult population be provided with opportunities to become accustomed to "Thinking Metric"; that State Departments of Education, colleges, and school systems should become more active in in-service training, and providing teacher consultants; and last but not least, to assure teachers that the job of the school is to provide students with basic knowledge of metrics adequate for living in our society and leave the specializing, if necessary, to on-the-job training and career vocations.[1]

It is necessary then that there be a sequentially developed teacher's guide and a curricular plan for metric education. If teachers are involved in adult training for business, on-the-job training, or career education, they should make appropriate choices of what is necessary to be taught at that level. Teachers should not try to teach the whole SI system with all its specialties, they must be selective. Most students and adults need to know only enough to function efficiently on the job or as a consumer. If metric skills are not usable anywhere but in the classroom, they will not be learned or retained.

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[1] Dominy. "Metrics A LaCarte", pp. 25-27.

Cooper stated:

> If we all do our jobs well, the domain of metric education should cease to exist as a special area of concern. We are responding to the start-up needs in programs that will require metrication. Once implemented, metric will be taught within the context of measurement. It will be learned as a primary system and customary will be taught as the secondary system.[1]

Eicher brought a new term for this process, functional literacy, and defines it as:

> Functional literacy should enable a person to communicate ideas relative to metric measures. . .The person who is functionally literate in the metric language does not need to revert to an English-metric conversion table to attach meaning to metric units about which he has read. If he reads or hears that a tower to be constructed is to be twenty-meters high, he can quickly visualize the approximate height and it has meaning for him.[2]

This seems to be an excellent example of "Think Metric."

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[1] Gloria S. Cooper, et. al. Metric Education: A Position Paper for Vocational, Technical and Adult Education. University of Ohio. (ERIC: Eric Document Reproduction Service, Ed 112 064) 1975, p. 13.

[2] Charles Eicher. Metric Talks, p. 75.

Chalupsky explained that the support of parent and community, so vital to the success of a metric education program, "can be enhanced through handout materials and special information campaigns."[1]

> Capitalizing on the power of children to educate parents (via handout materials) is a technique that is being employed in some Canadian schools, in addition to special school-sponsored parent workshops. Concerned consumer representatives in Canada sense the need for information saturation campaigns, involving displays and demonstrations, new product fanfare, increased media coverage, hand-out literature, special information centers, and brief mini-courses.[2]

Thus, the role of education is clearly defined. It is a most important role in metrication. The American public's problem is to unlearn the customary system of childhood and reach a functional literacy level in metrics. Emphasis should be put on "Think Metric" with no English-metric conversion. Schools are challenged to this task and should gear themselves to not only student, but community needs. Thompson's article, "Metrics: There's no U.S. 'mandate' to switch, but if you don't, you soon may be swimming upstream" seems to state the problem clearly

Industry

Although educational organizations have been extolling the virtues of metrication for decades, and although all other major countries made the switch, the United States did not begin metrication on a large scale until it became profitable for business.[1]

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[1] Chalupsky. "Canadian Experience," p. 102.

[2] Ibid., p. 102.

Many companies both large and small are becoming more and more involved in foreign trade. Small companies, which do not have direct trade with foreign nations, are woven in the metrication network by the fact that they supply parts to larger manufacturers. These are called vendors. Even the packaging industry is affected, for when size is taken into account, packages must be changed. This brings metrication to every city and town in the nation, as well as to millions of workers.[2]

Industry's goal is to have one set of worldwide inter-changeable common parts (engineering and product standard) for use in manufacturing finished products in any plant anywhere in the world.

Since all major countries in the world, except the U.S. are now on the metric system, they prefer to have their products made to metric specification.

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[1] Smith. "Role of Board" p.3.

[2] Mets Information Bulletin. (Palo Alto, Calif., American Institutes for Research, 1978), p. 2.

The European Economic Community (EEC) required that all documentation, labeling and instructions on imported products be in SI units beginning in 1979.[1]

Sokol told us that many Americans are aware that the United States must increase its exports of manufactured goods in order to keep its balance of payments in line. Any action that would help increase United States company exports of manufactured goods, will improve the balance of payments, thereby enhancing the economic health of the companies and of the country at large. Therefore, goods designed for export must be metric. It is wasteful and unrealistic for a nation to work in two measurement systems. Furthermore, workers will become less confused when they use the same measuring system both at home and at work. It is therefore to the advantage of all sectors of our society for the United States to complete the change to SI units as soon as economically feasible.[2]

One of the terms industry uses when talking about costs of metrication is "rule of reason" - a term used by Lewis Branscomb, former head of the National Bureau of Standards, and now I.B.M. Vice President. Branscomb stated that going metric is something people and companies will have to do themselves, at their own pace, and in their own way. His "rule of reason" says that almost no production machine need be scrapped because most machines can be adapted to produce metric materials. Those not adaptable can continue to produce the necessary non-metric materials until they wear out.

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[1] Ibid., p. 2.

[2] Louis F. Sokol. "The Case for Metrication," U. S. Metric Association Newsletter, 13, (May 1978)

Training workers under the "rule of reason" follows the pattern of just teaching them what they need to know to do their job - let the rest come about naturally.

Costs under the "rule of reason" show that companies planning to convert expect to recoup the costs within a few years because it is simpler and cheaper to do business with one measurement system, also, in most cases parts inventories will eventually be reduced far below todays level.[1] These "rules of reason" seem to echo Alexander Graham Bell's testimony.

One clear outcome from the Metric Study under DeSimone was that whatever the cost of conversion, it will be less if it takes place through an orderly process coordinated on a national level than if the nation continues in a haphazard drift toward metrication.

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[1] Alexander Groner, George Boehm. AMA Survey Report: Going Metric (New York: A.M.A. 1973) pp. 10-12.

Large companies such as Ford Motor Company, I.B.M., General Motors, International Harvester, Honey-Well Inc., Caterpillar Tractor Company, Deere and Company and Chrysler are just a few who are in some stage of metrication. By following the "rule of reason," they are finding that costs are not as great as anticipated because of the adaptability of some machines.[1]

Before starting complete metrication, Ford was turning out thirty percent of its product to metric standards. It is expensive to have two systems.

In 1973, General Motors announced a policy that generally fits the "rule of reason." All new products will be metric.

Caterpillar Tractor's basic policy requires parts and components manufactured anywhere in the world to be interchangeable. The company has begun to phase out the inch-pound and are designing new products to metric measurements.

Deere and Company conducted a special study on costs which showed that metrication is likely to amount to one million dollars a year if spread over ten years, but hundreds of millions of dollars if attempted in a single year.[2]

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[1] Deming. Power, p. 93.

[2] Groner, Boehm. A.M.A. Survey, pp. 18-20.

In 1978, John Deere has introduced its new 700 V-8 series of heavy duty higher power rating diesel engine, which is metrically designed and manufactured.[1]

The soft drink and liquor industries have taken the lead in going metric also by complying with regulations by the United States Bureau of Alcohol, Tobacco Products and Firearms. They regulated standarized metric sizes for containers of domestic and imported wines by 1970 and designated seven metric sizes for all wines sold after 1978. The public caught on to some of these metric changes and was pleasantly surprised when the Seven-Up Company gave the consumer a greater amount of their product, thereby capitalizing on the publicity and good customer response.[2]

However, the General Accounting Office, in its report to Congress in October 1978, cited the distilled liquor industry for price increases. It was found that there was a 6.1 percent increase for the one-half gallon to 1.75 liter shift, a 0.7 percent increase from the fifth to the 750 ml change and an 11.4 percent increase for the one-half pint to the 300 ml change.

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[1] U.S. Metric Association Newsletter, (May 1978), p.5

[2] Smith, "Role of Board," p. 3.

This study showed that the consumer was paying more for less because of the difference in volume. A fifth contains 25.6 fluid ounces while the 750 ml. contains 25.4 fluid ounces. The one-half gallon is 64 fluid ounces and the 1.75 liter is only 59.2 fluid ounces. The one-half pint is eight fluid ounces and the 200ml. is only 6.8 fluid ounces.

This G.A.O. report shows that the 200 ml. and 1.75 l. sizes are the most difficult to compare price wise and are "the sizes in which the industry made the highest price increases when metrification took place."[1]

The 'fair labeling' and 'unit pricing' acts now become important laws to protect the consumer during metrication. The G.A.O. report critized the Treasury Bureau of Alcohol, Tobacco and Firearms because it "should have insured that its actions protected the public interest. Because it did not do this properly, consumers were not adequately served."[2]

To say that all industry is in favor of metrication would be a gross error. However, it is safe to say that big industry - bringing along their vendors, will do more for metrication than any other sector except education.

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[1] "Booze Costs More in Metric Containers", Rock Island Argus, October 24, 1978, p. 2.

[2] Ibid., p. 2.

## Resistance

Deming told us that although the organized resistance to United States adoption to the metric system has all but disappeared, this does not mean that there is no resistance.[1] There is no organized resistance because the anti-metric people realize it is economically impossible for the United States to continue to cling to the old system while the world goes metric.

Nevertheless, there is considerable resistance to metrication. Ballew stated that the two main objections are the expense of converting and the resistance of people to change.[2] The first consideration is especially real to those industries which are not international, and to workers who would have to pay conversion costs out of their own pockets. It is in this area that labor unions are concerned. They are not anti-metric, but they are aware of the needs of the worker. These problems were voiced by small business and labor leaders in the Metric Survey of 1971, and again in the GAO report of 1978.

DeSimone's report included opinions and cost-benefit estimates concerning conversion to the metric from members of trade associations, labor unions, professional societies and other groups. John Motley of the National Federation of Independent Businesses commented:

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[1] Deming. Power, p. 51.

[2] Hunter Ballew. "Overcoming the Resistance to the Metric System," School Science and Math 73, March 1973, p. 178.

> Neither organized labor nor small business is convinced that metric is the right way to go for the United States. We don't feel that the metric advocates have proved their point. The small business community particularly has very little to gain from conversion; its cost is both high and needless.[1]

Brendan Somerville of the National Association of Manufacturers said:

> The biggest market for the manufacturing firms we represent is the United States itself--and it is largely nonmetric. So, while the NAM officially favors conversion to the metric system, we think it has a long way to go. Americans are showing even more resistance to changing familiar things than the British, where conversion to the metric system has been postponed for several years.[2]

The second objection lies with people who now must unlearn an enbedded measurement system and learn a new one. The G.A.O. report shows that "Most Americans polled in the GAO survey actually opposed any shift to metrication in this country."[3] As long as products or signs are presented in both systems, confusion will reign. To successfully convert to the metric system, the public will have to unlearn the customary system and "Think Metric." A national soft conversion campaign, would help smooth the way for public acceptance. Chalupsky writes that "underlying every stage of metric education is the need for clear and complete communication."

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[1] DeSimone, Metric Study, p. 32.

[2] Ibid., p. 45.

[3] "Rising Backlash Against Switch to Metrics," U. S. News & World Report, November 13, 1978, p. 77.

> This need has appeared over and over again no matter what area of metric education--or metric conversion--is discussed. The importance of good communication to everyone cannot be overemphasized.[1]

Some other objections which are expressed in newspaper letters, or oral comments are fear of the United States becoming part of one world; a Communist plot (all Communist countries are metric); industry will take advantage of the consumer giving them less for more money (GAO report on liquor measures). In this regard, consumer confidence is immensly important. The consumer needs to be assured that their interests are protected. The packaging and marketing of consumer goods is highly important.

Some metric opponents claim that the principle cause of any loss of foreign business is high labor costs, not a system of measurements - and so the arguments go.

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[1] Chalupsky. "Canadian Experience," p. 103.

The GAO survey reports that:

> A matter to be considered is whether the use of the metric system throughout the world warrants the effort and expense needed to convert our day-to-day affairs, such as highway speed limits, consumer products and weather reporting into metric measure.[1]

It further stated:

> It is not too late to make the decision as to which system is to be predominant. . .Metrication would affect Americans at work, in school, at home, in shopping and in their leisure activities. Every organization, firm, industry and level of government would feel its impact. The impact would surprise many Americans and affect them all in many and varied ways. No country with an economy and population anywhere near the size of the United States has converted to the metric system.[2]

Summary

As the history review has shown, the metric controversy has been with the country since its formation. The law of 1866 formally named the metric system as the official system of weights and measures in the United States. The bill signed by President Ford in 1975 finally set the stage for metrication implementation in the United States.

The metric system, as has been shown, is used in the U.S. to a greater extent than is generally realized. Over the past one hundred years, metrics have been slowly, steadily seeping into the every-day lives of the American people. Most have been exposed to it repeatedly without realizing it; in films, medicine and drugs, and beverages.

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[1] Rising Backlash, p. 77.

[2] Ibid., p. 77.

When the U.S. goes completely metric, the entire world, with small exception, will be using the same measurement language. This will facilitate communication between countries.

As seen, education will have to expand into the community to break down adult resistance. Apprehension occurs when change is proposed - especially in something as embedded as our measuring system. John Q. Adams expressed this well in his report to Congress in 1821. Review of other countries show grave difficulties are encountered when the public is left out of metrication programs.

The Canadian experience has been found to be the most ideal of foreign countries conversion, and the suggestion has been made that the U.S. follow its example, improving on the weaknesses found.

No problem with elementary children is anticipated other than the fear their teachers experience who are not competent to teach the metric system. The main problem will be to try to get children and adults to "Think Metric." As Alexander Graham Bell stated, it causes no trouble when only the metric system is used, and even the common man can learn it.

For functional literacy, it is only necessary for adults and children to learn the basic metric units, the ones necessary for their everyday living. Any other units can be learned when the need arises.

Also, in schools, the elementary task will be smaller since multiplication and division of fractions will not have to be taught until children are better able to handle the abstract.

Industry is providing the impetus for metrication as speedily as possible. Already many large industries have started metric programs. They feel, although the costs will be great, they will experience more profit. Besides, by using the "rule of reason" they are able to make changes only when it is economically feasible and generally speaking the costs will be far outweighed by lower inventories and the simplicity of the system, as well as increased profits.

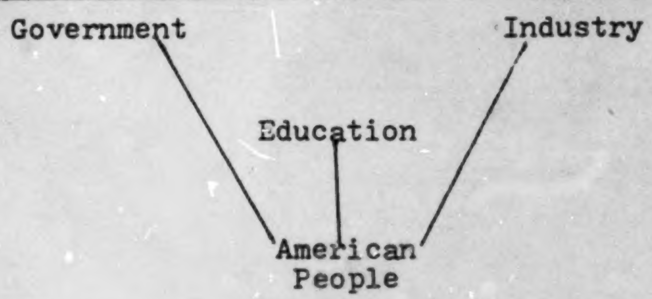
Resistance to metrication is still very much with us. As shown by DeSimone's Metric Survey of 1971 and the GAO Survey of 1978, small businessmen and the average Americans are still not sure this change is needed or necessary.

On the whole metrication will affect Americans in every walk of life: the consumer, the student, the worker, not only in their daily work and living, but in their leisure activities as well. If the barrier of fear is broken down through education, then metrication can happen more smoothly. However, government, industry and education will all have to cooperate to accomplish this goal, and it is possible that, in spite of their cooperation, this barrier will never be overcome.

## III. METHODOLOGY

As was found from the review of literature, government, industry, and education are catalysts in leading a movement toward metrication for the American people. This is shown in Figure 1.

Figure 1.-Movement toward metrication



The problem with this change lies in the resistance, due to lack of education, of parents and educators. If a functional literacy level in the metric system were reached by parents, and a competency level were reached by educators, the barrier of resistance to the change would be lessened and metrication could possibly be implemented easily and with very little pain.

Several research questions are posed regarding this problem:

1. What are the educational needs of parents to reach literacy in the metric system?

2. What are the educational needs of educators to reach competency in the metric system?

3. What are the attitudes of parents toward metrication?

4. What are the attitudes of educators toward metrication?

5. What is the greatest problem envisioned by parents regarding metrication?

6. What is the greatest problem envisioned by educators regarding metrication?

7. To what degree would parents and/or educators attend workshops, read, and so forth to gain more knowledge in the metric system?

8. Does age, education, or community have any influence on knowledge and/or attitude of parents and/or educators?

## Design

To conduct this study, which was a needs assessment survey, a questionnaire was devised. It was constructed using a Likert-type scale measuring parent and educator attitude, perceptive level of knowledge, problems envisioned, and willingness to increase knowledge and participate in further education in regard to the metric system. The variables of age, education, and community, where the samples live, were probed.

The instrument was validated in the following manner: a pilot study was conducted by asking seven parents and thirteen educators from outside the selected population to cooperate by completing the questionnaire. It was found that the questionnaire, as written, communicated clearly and no problem was found with individual questions. In analyzing these questionnaires, research questions seemed to be answered accurately. Based on this pilot study, the final questionnaire was printed.[1]

The researcher then contacted the Superintendent of Schools in each district to obtain their permission for the study. Permission was granted in both school districts both by the superintendents and principals. Then, in the presence in one case of two school authorities, and in the other of a building principal, ten classrooms from each district were randomly drawn. In addition to the ten classrooms for each district, classrooms number eleven, twelve, and thirteen were also drawn. These were alternates if cooperation from the selected teachers could not be obtained. Classroom number eleven was to be the first replacement, classroom number twelve the second, and then, if necessary, classroom number thirteen as third replacement.

After all the selections were made, permission for the survey was obtained from the teachers of the selected classrooms. Each teacher was personally contacted by phone and indicated willingness to participate. Classrooms number eleven, twelve, and thirteen in both districts were not needed or used.

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[1] Page 107 in the appendix.

Intermediate unit sampling was used within the classrooms; i.e., all students' parents in the twenty classrooms were surveyed.

The questionnaires for parents, with cover letter, were distributed under the approval of school authorities and handed out by the classroom teacher to all students in the selected classrooms on a Monday, with the request that they be returned as soon as possible.

Educators were surveyed at the same time. The questionnaire, with cover letter, was sent to all teachers, K-5 in both districts. A request was made that the questionnaires be returned as soon as possible in the envelopes provided. Through this method, a high percentage of returns was expected. It was necessary to follow up some teachers with phone calls, but in the end, of the seven hundred fifteen questionnaires sent out, five hundred fifty-two were received. This made seventy-nine percent of parents and seventy-six percent of teachers responding, or an over all total of seventy-seven percent response.

The writer believes that this high percentage of questionnaire returns also reflected the anxiety of those surveyed, both pro and con to this very controversial question, and their desire to be heard.

## Analysis

When the completed questionnaires were received, the computer program of the Statistical Package for the Social Studies was used to analyze the data. They were compared and analyzed by parents and teachers, to determine what, if any, the educational needs (as seen in their milleu), and the attitudes of both are toward metrication.

Also evaluated, was the willingness of the sample to learn more about metrics, the degree they would participate in further education, as well as the greatest problem envisioned by them in this change. The variables of age, education, and community were evaluated to see if they had any influence on responses to questions posed.

The questionnaires were analyzed on a dual level, the inferential level and the descriptive level. The Chi Square was used to analyze on the inferential level with an .05 level of significance set. Frequencies were observed for the descriptive level.

## Summary

A needs assessment questionnaire survey was conducted. The questionnaire was devised to answer questions posed by the researcher. The questionnaire was constructed using a Likert-type scale to measure attitude, perceptive level of knowledge, and willingness to increase knowledge in regard to the metric system. Also included were questions on age, education, and community.

A pilot study was made using seven parents and thirteen teachers. Through this study, the questionnaire was found to communicate clearly with no problems with individual questions. It was then printed.

Permission was obtained from the superintendent of schools and principals in both districts to conduct the survey. In the presence of school officials, ten classrooms in each district were selected randomly for surveying. Teachers so chosen were contacted before questionnaires were sent to them. Intermediate unit sampling was used, in that all students' parents within the chosen classrooms were surveyed. Questionnaires were sent to these clasroom teachers with the request that they be given out to students on a Monday and returned as soon as possible.

Teachers, K-5 in both districts were also sent questionnaires, with cover letter. They were requested to return them in the envelopes provided. In all, seven hundred fifteen questionnaires were sent out with five hundred forty-nine being received, for a total of seventy-seven percent.

These questionnaires were analyzed by the computer program of the Statistical Package for Social Studies.

They were analyzed on a dual level; the inferential level using the Chi Square with a .05 level of significance set, and the descriptive level by observing frequencies.

They were examined by parents and educators, probing their needs and attitudes in regard to the metric system. The variables of age, education, and community were used to see what influence, if any, they had on the questions raised.

The combined responses of parents and educators were observed by frequencies.

## IV. ANALYSIS OF DATA

A very high percentage of the questionnaires sent out were received for analysis. Table 1 shows the numbers of questionnaires sent out and received by parents and educators, and by school districts. Percentages of these are also shown on this table.

TABLE 1.-Number of questionnaires sent and received.

| | Parents | | Teachers | |
|---|---|---|---|---|
| | Sent | Received | Sent | Received |
| Urban School District | 243 | 180 | 228 | 158 |
| Percent Received | 74% | | 69% | |
| Small School District | 214 | 181 | 30 | 30 |
| Percent Received | 85% | | 100% | |
| Totals Sent and Received | 457 | 361 | 258 | 188 |
| Total Percent Received | 79% | | 76% | |

Frequencies, cross tabulations, and the Chi Square were used to analyze each research question by the responses to the questionnaires. The analysis was made on a dual level, the inferential level, using the Chi Square, and the descriptive level, using the observed frequencies. This section will show the Chi Square analysis of the variables named in research question eight, age, education, and community, by first parents and then by educators. Following this, the frequencies of the combined responses of parents and educators were observed regarding each research question, and the percentages are stated. Although frequencies do not reveal any statistical significance, they do reveal how parents and educators perceive their needs and attitudes in regard to the metric system.

Parents - Chi Square Analysis

Three null hypotheses were stated for research question one: What are the educational needs of parents to reach literacy in the metric system?

$H_o1$ The factor of parent age is not significantly related to the educational needs of parents to reach literacy in the metric system.

$H_o2$ The factor of parent education is not significantly related to the educational needs of parents to reach literacy in the metric system.

$H_o3$ The factor of parent community is not significantly related to the educational needs of parents to reach literacy in the metric system.

Four questions on the questionnaire, questions one, two, three, and four related to research question one, and were analyzed using the null hypothesis: The factor of parent age is not significantly related to the educational needs of parents to reach literacy in the metric system.

A Chi Square analysis[1] of responses to questions one, two, three, and four in relation to age of parents reveal none of them with a difference that is significant at the .05 level. Therefore the null hypothesis was retained.

$H_o2$ The factor of parent education is not significantly related to the educational needs of parents to reach literacy in the metric system, was examined by responses to these same four questions. It was found by a Chi Square analysis[2], that responses to questions one and two were significant at the .05 level.

Question one, asking the perceived parent knowledge of the metric system, had a calculated Chi Square value of 90.6708 that is significant at the 0.0001 level.

Question two, asking parent perception of how much value lectures open and free of charge to the public would help metrication, had a calculated Chi Square value of 25.74290 that is significant at the 0.0117 level. This study shows that education of parents in there two cases was significant in regard to educational needs of parents in the metric system. However, the Chi Square analysis of the other two questions showed no significant differences. The two questions which were found to be significant were more fundamental than the two which were found not significant. These two were more limited. Since responses to two of the four questions were found to be significant, and these two questions were more fundamental, the null hypothesis was rejected. This study shows that the education of parents was found to be a significant factor in relationship to their educational needs.

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[1] Table 2 in the appendix shows the frequencies of parent responses for each question by age, the Chi Square value for each, as well as the level at which the observed differences would be significant.

[2] Table 3 in the appendix shows the frequencies of parent responses for each question by education, the Chi Square value for each, as well as the level at which the observed differences would be significant.

Ho3 The factor of parent community is not significantly related to the educational needs of parents to reach literacy in the metric system was analyzed by responses to these same four questions, by the Chi Square.[1]

Questions two, three, and four were found to be different significantly at the .05 level. How much parents felt they knew about the metric system was not found to be significantly different by community; however, how they perceived lectures, media presentations, and workshops to help metrication showed significant differences by community.

Question two, regarding lectures free of charge to the public to help metrication, revealed a calculated Chi Square value of 21.67816 that is significant at the 0.0413 level.

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[1] Table 4 in the appendix shows the frequencies of parent responses for each question by community, the Chi Square value for each, as well as the level at which the observed differences would be significant.

Question three, regarding media presentations open and free of charge to the public to aid metrication, had a calculated Chi Square value of 28.5872 that is significant at the 0.0045 level.

Question four, regarding workshops with audience participation, open and free of charge to the public to help metrication, revealed a calculated Chi Square value of 24.68599 that is significant at the 0.0164 level.

Since responses to three out of four of the questions showed a significant relationship between parent educational needs for literacy in the metric system, and the communities where they live, the null hypothesis was rejected. This study shows that communities where parents live were found to be a significant factor in relation to parent educational needs.

Three null hypotheses were stated for research question three: What are the attitudes of parents toward metrication?

$H_01$ The factor of parent age is not significantly related to their attitude toward the metric system.

$H_02$ The factor of parent education is not significantly related to their attitude toward the metric system.

$H_o3$ The factor of parent community is not significantly related to their attitude toward the metric system.

Eight questions on the questionnaire, questions eight, nine, ten, eleven, twelve, thirteen, nineteen, and twenty, related to research question three.

$H_o1$ The factor of parent age is not significantly related to their attitude toward the metric system was analyzed by parent responses to these eight questions.

The Chi Square analysis[1] showed that responses to questions nine, ten, eleven, twelve, and thirteen were not found to be significantly different with regard to parent age and their attitude toward the metric system.

Question eight, however, regarding the height of a person in metrics, showed a calculated Chi Square value of 24.26414 that is significant at the 0.0187 level.

Question nineteen, regarding the parent perception of the statement that the great majority of American parents are in favor of changing to the metric system, revealed a calculated Chi Square value of 30.79366 that is significant at the 0.0021 level.

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[1] Table 5 in the appendix shows the frequencies of parent responses for each question by age, the Chi Square value for each, as well as the level at which the observed differences would be significant.

Question twenty, regarding the parent perception of the statement that the great majority of American educators are in favor of changing to the metric system, had a calculated Chi Square value of 31.89827 that is significant at the 0.0014 level.

Since responses to only three of the eight questions, in relation to parent age, were found to be significantly different within the .05 level, the null hypothesis, the factor of parent age is not significantly related to parent attitude toward the metric system, was retained.

$H_o$2 The factor of parent education is not significantly related to their attitude toward the metric system, was examined in regard to these same eight questions. A Chi Square analysis[1] of these responses showed questions eight, nine, ten, twelve, and nineteen were significant within the .05 level in relation to parent education.

Question eight, regarding height of a person in metrics, revealed a calculated Chi Square value of 30.87727 that is significant at the 0.0021 level.

Question nine, regarding metric speed limits, showed a calculated Chi Square value of 21.02460 that is significant at the 0,0500 level.

Question ten, regarding oil and gasoline measurements in metrics, had a calculated Chi Square value of 31.76845 that is significant at the 0.0015 level.

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[1] Table 6 in the appendix shows frequencies of parent responses for each question with regard to their education, the Chi Square value for each, as well as the level at which the observed differences would be significant.

Question twelve, regarding home thermostats, had a calculated Chi Square value of 25.31583 that is significant at the 0.0134 level.

Question thirteen, regarding sports distances, revealed a calculated Chi Square value of 24.38420 that is significant at the 0.0180 level.

Since five out of the eight questions showed that differences in responses in relation to parent education were significant within the .05 level, the null hypothesis was rejected. This study shows that education of parents was found to be significant in relation to their attitude toward the metric system.

$H_o3$ The factor of parent community is not significantly related to their attitudes toward the metric system, was examined by parent responses to these same eight questions. The Chi Square analysis[1] showed that all of the responses to these questions were found to be of significant difference when comparing parent attitude with the communities where they live.

Question eight, regarding metric height of a person, had a calculated Chi Square value of 42.54948 that is significant at the 0.0000[1] level.

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[1] Table 7 in the appendix shows the frequencies of parent responses for each question by community, the Chi Square value for each, as well as the level at which the observed differences would be significant.

Question nine, regarding metric speed limits, revealed a calculated Chi Square value of 48.92270 that is significant at the 0.0000[2] level.

Question ten, regarding metric oil and gasoline measurements, showed a calculated Chi Square value of 28.08121 that is significant at the 0.0054 level.

Question eleven, regarding metric mass of coins, revealed a calculated Chi Square value of 31.96355 that is significant at the 0.0014 level.

Question twelve, regarding home thermostats, showed a calculated Chi Square value of 63.67657 that is significant at the 0.0000[3] level.

Question thirteen, regarding metric distances in American sports revealed a calculated Chi Square value of 33.65785 that is significant at the 0.0008 level.

Question nineteen, regarding the parents' perception of the statement that the great majority of American parents are in favor of changing to the metric system, revealed a calculated Chi Square value of 36.46635 that is significant at the 0.0003 level.

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[1] Whereas there is not literally a significance at the "0" level, the computer printout shows a significance beyond the 0.00005 level and hence rounded off the value to "0.0000".

[2] Ibid.

[3] Ibid.

Question twenty, regarding the parents perception of the statement that the great majority of American teachers are in favor of changing to the metric system, showed a calculated Chi Square value of 31.06262 that is significant at the 0.0019 level.

Since parent responses to all eight questions showed a significant difference at the .05 level, the null hypothesis, the factor of parent community is not significantly related to parent attitude toward the metric system, was rejected. This study shows there is a significant relationship between parent attitude toward the metric system and the community where they live.

Three null hypotheses were stated for research question five: What is the greatest problem envisioned by parents regarding metrication?

$H_0 1$ The factor of parent age is not significantly related to the greatest problem envisioned by parents regarding metrication.

$H_0 2$ The factor of parent education is not significantly related to the greatest problem envisioned by parents regarding metrication.

$H_0 3$ The factor of parent community is not significantly related to the greatest problem envisioned by parents regarding metrication.

Six questions on the questionnaire, questions fourteen, fifteen, sixteen, seventeen, eighteen, and twenty-one related to this research question.

A Chi Square analysis[1] was made of responses to these questions regarding the null hypothesis, the factor of parent age is not significantly related to the greatest problem envisioned by parents regarding metrication. This analysis showed that the differences in responses to these questions was not found to be significant at the .05 level and therefore, the null hypothesis was retained.

$H_o2$ The factor of parent education is not significantly related to the greatest problem envisioned by parents regarding the metric system, was tested by responses of parents to these same six questions.

A Chi Square analysis[2] of parent responses to these questions showed that questions eighteen and twenty-one showed a difference within the .05 level of significance. The other four questions were not found significantly different.

Question eighteen, regarding parent perception of the statement that the United States should adopt the metric system because the rest of the world already has, revealed a Chi Square value of 38.09451 that is significant at the 0.0001 level.

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[1] Table 8 in the appendix shows the frequencies of parent responses for each question by age, the Chi Square value for each, as well as the level at which the observed differences would be significant.

[2] Table 9 in the appendix shows the frequencies of parent responses for each question by education, the Chi Square value for each, as well as the level at which the observed differences would be significant.

Question twenty-one, regarding the parent perception of the statement that all the educational resources in the United States must contribute to the education of the entire population to change over to the metric system, revealed a Chi Square value of 30.30321 which is significant at the 0.0025 level.

Since four out of the six questions, in regard to the factor of education of parents, did not show responses by them to have differences within the .05 level of significance, the null hypothesis was retained.

$H_03$ The factor of parent community is not significantly related to the greatest problem envisioned by parents regarding metrication, was tested by the same six questions.

A Chi Square analysis[1] of parent responses to the six questions showed that responses on all questions, but numbers seventeen and twenty-one, were found to have significant differences at the .05 level.

Question fourteen, which stated metrication will increase American exports and thereby improve our economy and help everybody, was found to have a calculated Chi

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[1] Table 10 in the appendix shows the frequencies of responses by parents for each question by communities, the Chi Square value for each, as well as the level at which the observed differences would be significant.

Square value of 39.45692 that is significant at the 0.0001 level.

Question fifteen, regarding the statement children graduating from American schools will move into a metric world for which they must be educated, revealed a calculated Chi Square value of 28.79871 that is significant at the 0.0042 level.

Question sixteen, regarding the statement American workers must now use American measures and metric measures. If they used only one, they would become more efficient, showed a calculated Chi Square value of 25.75671 that is significant at the 0.0116 level.

Question eighteen, regarding the statement the United States should adopt the metric system because the rest of the world already has, showed a calculated Chi Square value of 41.91211 that is significant at the 0.0001 level.

Since responses to four out of the six questions show differences significant at the .05 level, the null hypothesis was rejected. This study shows that communities where parents live do have a relationship to the greatest problem envisioned by parents regarding metrication.

Three null hypotheses were stated for research question seven: To what degree would parents attend workshops, read, and so forth to gain more knowledge in the metric system?

$H_o1$ The factor of parent age is not significantly related to their willingness to attend workshops, read, and so forth to gain more knowledge in the metric system.

$H_o2$ The factor of parent education is not significantly related to their willingness to attend workshops, read, and so forth to gain more knowledge in the metric system.

$H_o3$ The factor of parent community is not significantly related to their willingness to attend workshops, read, and so forth to gain more knowledge in the metric system.

Three questions in the questionnaire, questions five, six, and seven, relate to research question seven.

$H_o1$ The factor of parent age is not significantly related to their willingness to attend workshops, read, and so forth to gain more knowledge in the metric system, was tested by responses to these three questions.

A Chi Square analysis[1] of responses to these questions revealed none of them with a difference that is significant at the .05 level. Therefore the null hypothesis was retained.

$H_o2$ The factor of parent education is not significantly related to their willingness to attend workshops, read, and so forth to gain more knowledge in the metric system was tested by questions five, six, and seven.

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[1] Table 11 in the appendix shows the frequencies of parent responses for each question by age, the Chi Square value for each, as well as the level at which the observed differences would be significant.

A Chi Square analysis[1] showed that questions five and six were significantly different at the .05 level.

Question five, regarding parent willingness to attend some type of presentation free and open to the public on metrics, was found to have a calculated Chi Square value of 25.42299 that is significant at the 0.0129 level.

Question six, regarding the extent parents would be willing to participate in a free home study course to learn about the metric system, had a calculated Chi Square value of 21.73235 that is significant at the 0.0406 level.

Since responses to two out of three of these questions were found to have significant differences, the null hypothesis was rejected. This study shows that education of parents does have a relationship with their willingness to attend workshops, to read, and so forth to gain more knowledge in the metric system.

$H_o3$ The factor of parent community is not significantly related to their willingness to attend workshops, to read, and so forth to gain more knowledge in the metric system was analyzed by these same three questions.

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[1] Table 12 in the appendix shows the frequencies of parent responses for each question by education, the Chi Square value for each, as well as the level at which the observed differences would be significant.

A Chi Square analysis[1] showed that the responses to all three of these questions were found to be different significantly within the .05 level.

Question five, regarding the frequency parents would be willing to attend some type of presentation free and open to the public on metrics, was found to have a calculated Chi Square value of 20.75194 that is significant at the 0.0541 level.

Question six, regarding willingness of parents to participate in home study courses to learn about the metric system, had a calculated Chi Square value of 34.27332 that is significant at the 0.0006 level.

Question seven, regarding the total number of presentations on metrics parents would be willing to attend, had a calculated Chi Square value of 29.43021 that is significant at the 0.0034 level.

Since the responses to all three of these questions, with regard to parent community, were found to be significantly different, the null hypothesis was rejected.

This study shows that community does have a significant relationship to parent willingness to attend workshops, to read, and so forth to gain more knowledge in the metric system.

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[1] Table 13 in the appendix shows the frequencies of parent responses for each question by community, the Chi Square value for each, as well as the level at which the observed differences would be significant.

## Educators - Chi Square Analysis

Three null hypotheses were stated for research question two: What are the educational needs of educators to reach competency in the metric system?

$H_0 1$ The factor of educator age is not significantly related to the educational needs of educators to reach competency in the metric system.

$H_0 2$ The factor of education is not significantly related to the educational needs of educators to reach competency in the metric system.

$H_0 3$ The factor of educator community is not significantly related to the educational needs of educators to reach competency in the metric system.

Four questions on the questionnaire, questions one, two, three, and four, related to research question two, and were analyzed using the null hypothesis, the factor of educator age is not significantly related to the educational needs of educators to reach competency in the metric system.

A Chi Square analysis[1] of responses to question one, two, three, and four, in relation to age of educators, reveal none of them with a difference that is significant at the .05 level. Therefore the null hypothesis was retained.

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[1] Table 14 in the appendix shows the frequencies of educator responses for each question by age, the Chi Square value for each, as well as the level at which the observed differences would be significant.

$H_o2$ The factor of education is not significantly related to the educational needs of educators to reach competency in the metric system was examined by responses to these same four questions.

A Chi Square analysis[1] of responses to questions one, two, three, and four, in relation to the education of educators, again revealed none of them with a difference that is significant at the .05 level. Therefore the null hypothesis was retained.

$H_o3$ The factor of educator community is not significantly related to the educational needs of educators to reach competency in the metric system, was analyzed by responses to questions one, two, three, and four.

A Chi Square analysis[2] of responses to these questions revealed none of them with a difference that is significant at the .05 level. Therefore the null hypothesis was retained.

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[1] Table 15 in the appendix shows the frequencies of educator responses for each question by education, the Chi Square value for each, as well as the level at which the observed differences would be significant.

[2] Table 16 in the appendix shows the frequencies of educator responses for each question by community, the Chi Square value for each, as well as the level at which the observed differences would be significant.

Three null hypotheses were stated for research question four: What are the attitudes of educators toward metrication?

$H_o1$ The factor of educator age is not significantly related to their attitude toward the metric system.

$H_o2$ The factor of education of educators is not significantly related to their attitude toward the metric system.

$H_o3$ The factor of educator community is not significantly related to their attitude toward the metric system.

Eight questions on the questionnaire, questions eight, nine, ten, eleven, twelve, thirteen, nineteen, and twenty, related to research question four.

$H_o1$ The factor of educator age is not significantly related to their attitude toward the metric system was analyzed by educator responses to these eight questions.

A Chi Square analysis[1] showed that responses to questions nine, eleven, thirteen, and twenty were not found to be significantly different within the .05 level, with regard to educator age and their attitude toward the metric system.

Question eight, regarding height of a person in metrics, showed a calculated Chi Square value of 29.27179 that is significant at the 0.0222 level.

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[1] Table 17 in the appendix shows the frequencies of educator responses for each question by age, the Chi Square value for each, as well as the level at which the observed differences would be significant.

Question ten, regarding gasoline and oil liquid measures, had a calculated Chi Square value of 31.41122 that was significant at the 0.0119 level.

Question twelve, regarding home thermostat settings, revealed a calculated Chi Square value of 34.89676 that is significant at the 0.0041 level.

Question nineteen, regarding educators' perception of the statement that the great majority of American parents are in favor of changing to the metric system, revealed a calculated Chi Square value of 29.14374 that is significant at the 0.0230 level.

Since responses to four of the eight questions were found to be different significantly within the .05 level, and since these questions seemed more meaningful to persons individually than the other four questions, the null hypothesis, the factor of educator age is not significantly related to their attitude toward the metric system, was rejected.

This study shows that the factor of educator age is significant in relation to their attitude toward the metric system.

$H_0 2$ The factor of education of educators is not significantly related to their attitude toward the metric system was examined again by these same eight questions.

A Chi Square analysis[1] of responses to these questions in relation to education of educators revealed none of them with a difference that is significant at the .05 level. The null hypothesis was therefore retained.

$H_o3$ The factor of educator community is not significantly related to their attitude toward the metric system, was analyzed by the same eight questions.

A Chi Square analysis[2] of responses to these questions in relation to education of educators revealed none of them with a difference that is significant at the .05 level. Therefore the null hypothesis was retained.

Three null hypotheses were stated for research question number six which asks: What is the greatest problem envisioned by educators regarding metrication?

$H_o1$ The factor of educator age is not significantly related to the greatest problem envisioned by educators regarding metrication.

$H_o2$ The factor of education of educators is not significantly related to the greatest problem envisioned by educators regarding metrication.

$H_o3$ The factor of educator community is not significantly related to the greatest problem envisioned by educators regarding metrication.

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[1] Table 18 in the appendix shows the frequencies of educator responses for each question by education, the Chi Square value for each, as well as the level at which the observed differences would be significant.

[2] Table 19 in the appendix shows the frequencies of educator responses for each question by community, the Chi Square value for each, as well as the level at which the observed differences would be significant.

Six questions on the questionnaire, questions fourteen, fifteen, sixteen, seventeen, eighteen, and twenty-one related to this research question.

$H_o1$ The factor of educator age is not significantly related to the greatest problem envisioned by educators regarding metrication was analyzed by these six questions.

A Chi Square analysis[1] of responses to these questions in relation to age of educators reveal none of them with a difference that is significant at the .05 level. Therefore the null hypothesis was retained.

$H_o2$ The factor of education of educators is not significantly related to the greatest problem envisioned by educators regarding metrication, was analyzed by these same six questions.

A Chi Square analysis[2] showed that all of the responses to the questions with the exception of questions fourteen and twenty-one did not show a difference within the .05 level of significance.

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[1] Table 20 in the appendix shows the frequencies of educator responses for each question by age, the Chi Square value for each, as well as the level at which the observed differences would be significant.

[2] Table 21 in the appendix shows the frequencies of educator responses for each question by education of educators, the Chi Square value for each as well as the level at which the observed differences would be significant.

Question fourteen, regarding the statement that metrication will increase American exports and thereby improve our economy and help everybody, revealed a calculated Chi Square value of 21.71474 that is significant at the 0.0055 level.

Question twenty-one, regarding the statement, all the educational resources in the United States must contribute to the education of the entire population to change over to the metric system, revealed a calculated Chi Square value of 14.95999 that is significant at the 0.0599 level.

Since responses to four out of the six questions were not found to have a difference that is significant at the .05 level, the null hypothesis, the factor of education is not significantly related to the greatest problem envisioned by educators regarding metrication, was retained.

$H_o3$ The factor of educator community is not significantly related to the greatest problem envisioned by educators regarding metrication, was examined by these same six questions.

A Chi Square analysis[1] of responses to these questions in relation to educator community reveal none of them with a difference that is significant at the .05 level. Therefore, the null hypothesis was retained.

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[1] Table 22 in the appendix shows the frequencies of educator responses for each question by community, the Chi Square value for each, as well as the level at which the observed differences would be significant.

Three null hypotheses were stated for research question number seven: To what degree would educators attend workshops, read, and so forth to gain more knowledge in the metric system?

$H_o1$ The factor of educator age is not significantly related to their willingness to attend workshops, to read and so forth to gain more knowledge in the metric system.

$H_o2$ The factor of education is not significantly related to educator's willingness to attend workshops, to read, and so forth to gain more knowledge in the metric system.

$H_o3$ The factor of educator community is not significantly related to their willingness to attend workshops, to read, and so forth to gain more knowledge in the metric system.

Three questions on the questionnaire, questions five, six, and seven, related to this research question.

A Chi Square analysis[1] of these three questions revealed that only question number five was found to be significantly different.

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[1] Table 23 in the appendix shows the frequencies of responses by educators in regard to age, the Chi Square value for each, as well as the level at which the observed differences would be significant.

Question five, relating to the willingness of educators to attend some type of presentation free and open to the public in relation to their age, revealed a calculated Chi Square value of 25.944 that is significant at the 0.0548 level.

The responses to the other two questions revealed neither of them with a difference that is significant at the .05 level. Therefore the null hypothesis was retained.

$H_o2$ The factor of education of educators is not significantly related to their willingness to attend workshops, to read, and so forth to gain more knowledge in the metric system was analyzed by questions five, six, and seven.

A Chi Square analysis[1] of responses to these questions in relation to the education of educators, reveal none of them with a difference that is significant at the .05 level. Therefore the null hypothesis was retained.

$H_o3$ The factor of educator community is not significantly related to their willingness to attend workshops, to read, and so forth to gain more knowledge in the metric system, was probed by questions five, six, and seven.

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[1] Table 24 in the appendix shows the frequencies of responses of educators in regard to education, the Chi Square value for each, as well as the level at which the observed differences would be significant.

A Chi Square analysis[1] of responses to these questions by educators in relation to community where educators live, reveal none of them with a difference that is significant at .05 level. Therefore the null hypothesis was retained.

## FREQUENCIES

The combined responses of parents and educators were observed by frequencies, and by adjusted frequencies (percents).

Research questions one and two asked: What are the educational needs of parents to reach literacy in the metric system? What are the educational needs of educators to reach competency in the metric system?

Observed adjusted frequencies[1] of the combined responses of parents and educators to questionnaire questions which relate to these two research questions are as follows:

1. How much do you know about the metric system?

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[1] Table 25 in the appendix shows the frequencies of educator responses for each question by community, the Chi Square value for each, as well as the level at which the observed differences would be significant.

[2] Table 26 in the appendix shows the combined frequencies of parents and educators responses for each of these questions, as well as the adjusted frequencies (percents).

Responses to very much and much were 19.8%, while 80.2% responded to some, very little, or don't know.

2. Do you think lectures open and free of charge to the public would help metrication? Responses to very much and much were 21.3%, while 78.7% responded to some, none, or don't know.

3. How much do you think media presentations, (T.V., movies, filmstrips etc.) open free of charge to the public would help metrication? Responses to very much and much were 33.7%, while 66.3% responded to some, none, or don't know.

4. Do you think workshops with audience participation, open and free of charge to the public would help metrication? Responses to very much and much were 26.1%, while 73.9% responded to some, none, or don't know.

Research questions three and four asked: What are the attitudes of parents toward metrication? What are the attitudes of educators toward metrication?

Eight questions on the questionnaire, questions eight, nine, ten, eleven, twelve, thirteen, nineteen, and twenty related to these research questions.

Observed adjusted frequencies[1] of the combined responses of parents and educators for these questions are as follows:

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[1] Table 27 in the appendix shows the combined frequencies of parent and educator responses for each of these questions, as well as the adjusted frequencies (percents).

8. How important do you think it is for Americans to know the height of a person in metric terms? Responses to very important and important were 19.6%, while 80.4% responded to some importance, no importance, or don't know.

9. How important do you think it is for Americans to know speed limits in metric terms? Responses to very important, and important were 39.7%, while 60.3% responded to some importance, no importance or don't know.

10. How important do you think it is for Americans to know oil and gasoline liquid measures in metric terms? Responses to very important and important were 41.6%, while 58.4% responded to some importance, no importance, or don't know.

11. How important do you think it is for Americans to know the mass (weight) of American coins in the metric system? Responses to very important and important were 21%, while 79% responded to some importance, no importance, or don't know.

12. How important do you think it is for Americans to know home thermostat settings in metric terms? Responses to very important and important were 31.3%, while 68.7% responded to some importance, no importance, and don't know.

13. How important do you think it is for Americans to

know distances involved in American sports in metric terms? Responses to very important and important were 35.4%, while 64.6% responded to some importance, no importance, and don't know.

19. The great majority of American parents are in favor of changing over to the metric system. Responses to strongly agree and agree were 8.6%, while 91.4% responded to disagree, strongly disagree, and uncertain.

20. The great majority of American teachers are in favor of changing over to the metric system. Responses to strongly agree and agree were 22.9%, while 77.1% responded to disagree, strongly disagree, and uncertain.

Research questions five and six stated: What is the greatest problem envisioned by parents regarding metrication? What is the greatest problem envisioned by educators regarding metrication?

Six questions on the questionnaire, questions fourteen, fifteen, sixteen, seventeen, eighteeen, and twenty-one related to these research questions.

Observed adjusted frequencies[1] of the combined responses of parents and educators for these questions are as follows:

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[1] Table 28 in the appendix shows the combined frequencies of parent and educator responses for each of these questions, as well as the adjusted frequencies (percents).

14. Metrication will increase American exports and thereby improve our economy and help everybody. Responses to strongly agree and agree were 26.2%, while 73.8% responded to disagree, strongly disagree, or uncertain.

15. Children graduating from American schools will move into a metric world for which they must be educated. Responses to strongly agree or agree were 61.5%, while 38.5% responded to disagree, strongly disagree, or uncertain.

16. American workers must now use American measures AND metric measures. If they used only one, they would become more efficient. Responses to strongly agree and agree were 57.1%, while 42.9% responded to disagree, strongly disagree, or uncertain.

17. American industry cannot wait ten years for the metric system to be implemented. Responses to strongly agree and agree were 30.1%, while 69.9% responded to disagree, strongly disagree, or uncertain.

18. The United States should adopt the metric system because the rest of the world already has. Responses to strongly agree and agree were 44.3%, while 55.7% responded to disagree, strongly disagree, or uncertain.

21. All the educational resources in the United States must contribute to the education of the entire population to change over to the metric system. Responses to

strongly agree and agree were 60%, while 40% responded to disagree, strongly disagree, and uncertain.

Research question seven asked: To what degree would parents and/or educators attend workshops, read, and so forth to gain more knowledge in the metric system?

Three questions on the questionnaire, questions five, six, and seven relate to this research question.

Observed adjusted frequencies[1] of the combined responses of parents and educators for these questions are as follows:

5. How frequently would you be willing to attend some type of presentation free and open to the public on metrics? Resonses to monthly, twice monthly, and weekly were 41.8%, while 58.3% responded to none, or don't know.

6. To what extent would you be willing to participate in a free home study course to learn about the metric system? Responses to very much, much, and some were 55.4%, while 44.6% responded to none and don't know.

7. What total number of presentations free and open to the public would you be willing to attend on metrics? Responses to twenty, fifteen, ten, and five were 61.8%, while 38.9% responded to none.

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[1] Table 29 in the appendix shows the combined frequencies of parent and educator responses for each of these questions, as well as the adjusted frequencies (percents).

## Summary

The data for this study was analyzed by frequencies, cross tabulations, and the Chi Square. The analysis was made on a dual level, the inferential level, using the Chi Square, and the descriptive level, using the observed frequencies. With regard to research question eight, the variables of age, education, and community were analyzed by the Chi Square for each research question. Frequencies of the combined responses for parents and educators were observed regarding each research question, and the adjusted frequencies were stated. Although these frequencies do not reveal statistical significance, they do reveal how parents and educators perceive their needs and attitudes in regard to the metric system.

### Chi Square - Parents

Three null hypotheses were stated for research questions one, three, five, and seven with regard to parents. These hypotheses were tested by a Chi Square analysis of questions on the questionnaire which pertained to the specific research question. The variables of age, education, and community were examined in relation to each question.

For research question one, regarding the educational needs of parents, the variable of age did not seem to show any significant difference. However, the factors of parent education and communities where they live, did have a significant relationship with their educational needs in the metric system.

Research question three, regarding attitude of parents to the metric system, showed the null hypothesis using the variable of age was retained. The null hypothesis pertaining to parent education and community where they lived were rejected. The Chi Square analysis for these two variables showed them to have a significant relationship to parent attitude toward the metric system.

For research question five, regarding the greatest problem envisioned by parents regarding the metric system, the same three null hypotheses regarding age, education, and community were stated. The Chi Square analysis revealed that the variables of age and education had no significant relationship to the greatest problem envisioned by parents regarding the metric system. These two null hypotheses were retained. However, the variable of community again showed a significant difference between the greatest problem envisioned by parents regarding the metric system and the communities where they live.

Three null hypotheses were stated for research question seven regarding parents' willingness to attend workshops, to read, and so forth to gain more knowledge in the metric system. The Chi Square analysis of the variables of age, education, and community showed that the variable of age was not found to be significantly different. That null hypothesis was retained. The analysis of education and community were again found to have differences that are significant at the .05 level, and these two null hypotheses were rejected. This study shows that parent education and communities where they live had significant differences in relation to parent willingness to attend workshops, to read, and so forth to gain more knowledge in the metric system.

This study showed that parent education revealed a significant difference with regard to parent need for education in the metric system, attitude toward the metric system, and their willingness to attend workshops, to read, and so forth to gain knowledge in the metric system. Education does seem to have a significant relationship to needs and attitudes of parents in regard to the metric system.

This study also showed that communities where parents live revealed significant differences on all four research questions. Communities where parents live do have a significant relationship with needs and attitudes of parents in regard to the metric system.

Chi Square - Educators

Research questions two, four, six, and seven related to educators. Three null hypotheses were stated for each question using the variables of age, education, and community. A Chi Square analysis was made for each question on the questionnaire, which pertained to specific research questions, using the variables of age, education and community.

For research question two, regarding educational needs of educators in the metric system, the three null hypotheses were retained when it was revealed that the Chi Square values did not show significant differences within the .05 level.

Three null hypotheses were stated for research question four, regarding attitude of educators to the metric system. A Chi Square analysis of these hypotheses showed that the factors of education of educators and the community where they live were not found to be significantly different. Therefore, the null hypotheses were retained in these cases.

The factor of age, however, showed a significant difference with regard to educators' attitude, and this null hypotheses was rejected. This study showed that there is a significant difference between educator attitude toward the metric system and their age.

For research question six, regarding the greatest problem envisioned by educators regarding metrication, three null hypotheses were stated. These hypotheses were tested using the variables of age, education, and community. A Chi Square analysis of responses to these questions revealed none of them with a difference that is significant at the .05 level. The three null hypotheses were retained.

For research question seven, regarding educator willingness to attend workshops, to read, and so forth to gain knowledge in the metric system, three null hypotheses were stated. These hypotheses were tested using the variables of age, education, and community. A Chi Square analysis of responses to these questions revealed none of them with a difference that is significant at the .05 level. The three null hypotheses were retained.

This study shows that the variable of age does have a significant relationship to educators' attitude to the metric system. The variables of age, education, and community in all other cases, did not seem to have any relationship to educators needs and attitudes in regard to the metric system.

## Frequencies - Parents and Educators

In observing frequencies of combined responses of parents and educators, only five of the twenty-one questions on the questionnaire showed percentages over fifty percent on the positive level. Questions six, seven, fifteen, sixteen, and twenty-one all showed positive combined responses, while all the other sixteen questions had combined responses of over fifty percent on the negative or no opinion level. The combined responses of parents and educators to questions nineteen and twenty were proportionately more negative than responses to the other questions. Question nineteen, stating that the great majority of American parents are in favor of changing to the metric system, showed that ninety-one percent were negative responses. Question twenty, stating that the great majority of American teachers were in favor of changing to the metric system, showed that seventy-seven percent responses were negative.

Questions which showed positive responses are:

6. To what extent would you be willing to participate in a free home study course to learn about the metric system?
7. What total number of presentations free and open to the public would you be willing to attend on metrics?
15. Children graduating from American schools will move into a metric world for which they must be educated.
16. American workers must now use American measures AND metric measures. If they used only one, they would become more efficient.
21. All the educational resources in the United States must contribute to the education of the entire population to change over to the metric system.

# CONCLUSIONS AND RECOMMENDATIONS

## Chi Square Analysis

The inferential analysis of data in this study shows significant differences at the .05 level on the Chi Square in relation to variables of parent education and communities where they live.

This study shows that:

1. Education of parents was found to be a significant factor in relation to their educational needs.
2. Communities where parents live were found to be a significant factor in relation to parent educational needs.
3. Education of parents was found to be a significant factor in relation to parent attitude toware the metric system.
4. Communities where parents live were found to be a significant factor in relation to parent attitude toward the metric system.
5. Communities where parents live were found to be a significant factor in relation to the greatest problem envisioned by parents in regard to the metric system.
6. Education of parents was found to be a significant factor in relation to parent willingness to attend workshops, to read, and so forth to gain more knowledge in the metric system.

7. Communities where parents live were found to be a significant factor in relation to parent willingness to attend workshops, to read, and so forth to gain more knowledge in the metric system.

From these findings, the education of parents, in some cases, and the communities where parents live, in all cases, are significant factors in relation to parent needs and attitudes in regard to the metric system.

A Chi Square analysis of educator responses revealed that educator age was a significant factor in relation to their attitude to the metric system. Responses to all other questions did not show any significant differences at the .05 level when testing the variables of age, education, and community. Therefore, this study shows that educator age shows a significant difference in relation to their attitude toward the metric system. This study also shows that the variables of age, education, and community are not significant factors in all other cases in relation to educator needs and attitudes in regard to the metric system.

Frequencies

The descriptive level of this study observed frequencies of answers to questions on the questionnaire in relation to research questions. In observing these frequencies, it was found that only responses to five of the questionnaire questions showed a positive response of over fifty percent. All other sixteen questions showed a negative response of over fifty percent.

Questions which showed positive responses are:

6. To what extent would you be willing to participate in a free home study course to learn about the metric system?

7. What total number of presentations, free and open to the public, would you be willing to attend on metrics?

15. Children graduating from American schools will move into a metric world for which they must be educated.

16. American workers must now use American measures AND metric measures. If they used only one, they would become more efficient.

21. All the educational resources in the United States must contribute to the education of the entire population to change over to the metric system.

These frequencies seem to show that although parents and educators do not feel the metric system is necessary or important to them, or that they want or need it, (responses for American parents against 91.4%, and responses for teachers 77.1% against), they do seem to feel it is important when children or the American worker is involved. They seem to be willing to attempt some study, home study or free presentations, to learn more about the SI units; and they feel that all the educational resources in the United States must contribute to the education of the entire population to change over to the metric system.

The review of literature revealed that government, industry, and education are leading a movement toward SI units for the American people. Government has decreed that SI units are the only legal measuring units in the United States. They have asked that the metric system be implemented within ten years, beginning in 1975.

Industry, because of its need for more foreign trade, is not only insisting on metrication, but will cause all its carriers to do likewise. The American worker finds himself caught between the two measuring systems. Within a very few years, companies hiring graduates of schools will require that they have a thorough knowledge of the SI units.

Education in most states has decreed that the metric system be taught exclusively, and parents are back in the "new math" syndrome not knowing what their children are learning.

Parents and educators seem to feel it is important that education take the lead. Although people may read about a subject, they are more likely to learn it if they have an opportunity to experience it on a person-to-person basis.

## Suggestions

These observations, based on frequencies of the combined responses of parents and educators, brought about the following suggestions:

1. That education take a stronger lead in teaching the metric system.
2. That all children from kindergarten on be taught SI units and be encouraged to involve their parents in learning them.
3. That workshops be held, through the schools, to help parents and educators become more familiar with SI units; thereby, hopefully reducing their anxiety toward the metric system.
4. That industry hold workshops for labor, thus easing the strain.
5. That educational television, with assistance from the government and states, provide more leadership for introducing the metric system.
6. That commercial television, of the public service variety, assign higher priority with budgets and resources to introduce the metric system to the public.

## Recommendations for Further Study

Further research should be undertaken to determine how accurate the parent and educator perception of their own needs is in regard to the metric system. Such research could include:

1. How much does parents' perception of their needs in the metric system agree with how much they actually know?

2. How much does educators' perception of their needs in the metric system agree with how much they actually know?

3. More research of the survey type should be conducted to learn what is being done on the local level to develop instructional materials and to instruct the public.

Answers to these questions would be of value to educators and to mass media personnel who teach SI units.

## Addendum

The review of literature gave examples of the American peoples' attitudes toward the metric system. Although the questionnaires did not have place for comments, some were written in and revealed attitudes similar to those expressed in the literature review. The author felt that some of the comments which were written in were pertinent to this study. Included among them are the following:

> I believe that the majority of Americans twenty-five years of age and older will do little or nothing about learning the metric system until everyday situations force them to do so.
>
> The question is how do we educate people quickly on the metric system, not which should be metric and which shouldn't. . . Anytime a measure is used, a person will be more efficient. It _must_ be metric. Should Congress make the change to metric mandatory? YES.

I agree that we should be prepared to relate to the metric system in dealing with nations who use it, but do not support mandatory changeover to it in this country.

I feel that if we are committed to the metric, we should switch period. The slow conversion and combining of the two is more confusing to people.

I see little problem in teaching school age children metrics. This is done in science and math classes. Application to useful life situations will be necessary. The major obstacle is convincing adults of the necessity for change. Adults prefer what they personally know and use in terms of measurements. It is the status quo attitude that must be overcome before they will be receptive to learning and using a different system. The cost of conversion in industry is a second obstacle.

Some people seem to be biased against anything new, regardless of attempts to enlighten then.

There is a predominately blue collar area and people here do not welcome change. Especially if it affects them directly. They would rather sit in front of their T.V. or go bowling than develop their mind.

People today will not leave their homes to attend meetings for anything - I'm sure the metric system would be a low priority to get up and out. Duplicate measures (both American and metric) will educate the housewife slowly and a man's work will educate him as his job requires. Schools must do the rest.

Education of the metric system should start in the schools with a slow change over so older people will join in. The cost is important especially these days.

We have survived with a dual system in the world. We can learn it when we need to do so. It should never be a study of conversion from one to the other. There is a difference between the nice to know and the need to know.

If business started using metrics, people would have to adopt.

I don't feel we need metric. What we have was good for my grandma and pa for their parents and so on. We've had our system for a long time and had no problem. Why confuse a lot of people by changing. It just makes for more schooling, more paper work. Someone just wants to make some money on something. Just leave us what we know and have. It's worked so far. The whole idea is stupid.

I think that changing over to the metric system is unnecessary - we have had the American Measure this long. Why change now?

Why do we have to export. Can't we use our own products? We should make everything for Americans.

We don't need foreign goods!

So what! - We don't need the rest of the world. We create and have everything we need right here.

I am not against education, and it should be on a voluntary or, if one would like to learn, not forced on everyone- whether they like it or not. I'd like to learn the metric for other interests other than free trade with all nations.

Let well enough alone.

I am not at all for the metric system, therefore have not studied much on the subject. I guess I am still hoping that the American system won't change.

Why change our system, just keeps our people and kids in mass confusion - a waste of tax money and time.

I have filled out this paper so you will be able to complete your study. I would like to add that I am against changing to

> metric system. Why must we change to it? We have done fine all these hundreds of years. When the people came here, they wanted us different. I think the whole thing is just another way for our so called free government to get us ready for the communist. And I think it is a shame we have lost our backbone and are letting them do it.

These comments parrot the comments in the review of literature and seem to cover all of the same points.

# APPENDIX A

## METRIC QUESTIONNAIRE

(Circle one answer)

1. How much do you know about the metric system?

   Very Much    Much    Don't Know    Some    Very Little

2. Do you think lectures open and free of charge to the public would help metrication? (change to the metric system)

   Very Much    Much    Don't Know    Some    None

3. How much do you think media presentations, (T.V., movies, filmstrips etc.) open free of charge to the public would help metrication?

   Very Much    Much    Don't Know    Some    None

4. Do you think workshops with audience participation, open and free of charge to the public would help metrication?

   Very Much    Much    Don't Know    Some    None

5. How frequently would you be willing to attend some type of presentation free and open to the public on metrics?

   Monthly    Twice Monthly    Don't Know    Weekly    None

6. To what extent would you be willing to participate ina free home study course to learn about the metric system?

   Very Much    Much    Don't Know    Some    None

7. What total number of presentations free and open to the public would you be willing to attend on metrics?

   20    15    10    5    0

8. How important do you think it is for Americans to know the height of a person in metric terms?

   Very Important    Important    Don't Know
   Some Importance    No Importance

Metric Questionnaire

9. How important do you think it is for Americans to know speed limits in metric terms?

Very Important Important Don't Know
Some Importance No Importance

10. How important do you think it is for Americans to know oil and gasoline liquid measures in metric terms?

Very Important Important Don't Know
Some Importance No Importance

11. How important do you think it is for Americans to know the mass (weights) of American coins in the metric system?

Very Important Important Don't Know
Some Importance No Importance

12. How important do you think it is for Americans to know home thermostat settings in metric terms?

Very Important Important Don't Know
Some Importance No Importance

13. How important do you think it is for Americans to know distances involved in American sports in metric terms?

Very Important Important Don't Know
Some Importance No Importance

TO WHAT EXTENT DO YOU AGREEE WITH THESE STATEMENTS?

14. Metrication will increase American exports and thereby improve our economy and help everybody.

Strongly Agree Agree Uncertain Disagree Strongly Disagree

15. Children graduating from American schools will move into a metric world for which they must be educated.

Strongly Agree Agree Uncertain Disagree Strongly Disagree

16. American workers must now use American measures AND metric measures. If they used only one, they would become more efficient.

Strongly Agree Agree Uncertain Disagree Strongly Disagree

Metric Questionnaire

17. American industry cannot wait ten years for the metric system to be implemented.

Strongly Agree  Agree  Uncertain  Disagree  Strongly Disagree

18. The United States should adopt the metric system because the rest of the world already has.

Strongly Agree  Agree  Uncertain  Disagree  Strongly Disagree

19. The great majority of American parents are in favor of changing over to the metric system.

Strongly Agree  Agree  Uncertain  Disagree  Strongly Disagree

20. The great majority of American teachers are in favor of changing over to the metric system.

Strongly Agree  Agree  Uncertain  Disagree  Strongly Disagree

21. All the educational resources in the United States must contribute to the educating of the entire population to change over to the metric system.

Strongly Agree  Agree  Uncertain  Disagree  Strongly Disagree

Your Age: Under 25  25-40  41-55  56-65  Over 65

Your Education: 0-11 grades  12 grades  Some college  College degree

Population Where You Live: Under 10,000  10,000-25,000  25,000-50,000  Over 50,000

# APPENDIX B

## EXPLANATION OF TABLES

It was necessary to differentiate between research questions and questionnaire questions on the tables. Because space was limited, the legend on each individual table reads, "Questionnaire No._____" rather than "Questionnaire Question No._____."

The horizontal numbers on these individual tables refer to responses on each questionnaire question in a decending order; that is, Very Much (5), Much (4), Don't Know (3), Some (2), Very Little (1).

The vertical numbers on each individual table refer to age, education and community in an ascending order as follows:

Age: Under 25 (1), 25-40 (2), 41-55 (3), 56-65 (4), over 65 (5).

Education: 0-11 grades (1), 12 grades (2), Some College (3), College Degree (4), row (5) has no meaning.

Community: Under 10,000 (1), 10,000-25,000 (2), 25,000-50,000 (3), over 50,000 (4), row (5) has no meaning.

TABLE 2.--Responses of parents showing relationship of their age to their perception of metric knowledge: research question 1

Questionnaire No. 1

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 4 | 7 | 1 | 1 | 0 |
| 2 | 131 | 106 | 22 | 26 | 13 |
| 3 | 17 | 16 | 3 | 6 | 1 |
| 4 | 2 | 0 | 1 | 0 | 1 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 11.52993
Level of Significance 0.4841

Questionnaire No. 2

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 10 | 1 | 1 | 1 |
| 2 | 38 | 149 | 43 | 30 | 39 |
| 3 | 2 | 25 | 8 | 4 | 4 |
| 4 | 0 | 0 | 1 | 1 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 15.59605
Level of Significance 0.2104

Questionnaire No. 3

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 7 | 1 | 4 | 1 |
| 2 | 30 | 140 | 30 | 54 | 44 |
| 3 | 3 | 24 | 3 | 8 | 5 |
| 4 | 0 | 1 | 0 | 0 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 11.39921
Level of Significance 0.4951

Questionnaire No. 4

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 7 | 2 | 4 | 0 |
| 2 | 38 | 146 | 34 | 44 | 38 |
| 3 | 5 | 21 | 6 | 9 | 2 |
| 4 | 0 | 2 | 0 | 0 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 15.13086
Level of Significance 0.2344

TABLE 3.--Responses of parents showing relationship of their education to their perception of metric knowledge: research question 1

Questionnaire No. 1

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 27 | 11 | 15 | 1 | 1 |
| 2 | 75 | 49 | 8 | 6 | 3 |
| 3 | 41 | 43 | 3 | 14 | 2 |
| 4 | 11 | 27 | 1 | 12 | 9 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 90.67082
Level of Significance 0.0001

Questionnaire No. 2

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 5 | 26 | 17 | 4 | 3 |
| 2 | 12 | 76 | 19 | 14 | 21 |
| 3 | 13 | 48 | 11 | 12 | 20 |
| 4 | 10 | 34 | 6 | 6 | 3 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 25.74290
Level of Significance 0.0117

Questionnaire No. 3

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 6 | 24 | 12 | 5 | 7 |
| 2 | 14 | 64 | 12 | 29 | 21 |
| 3 | 8 | 53 | 7 | 18 | 18 |
| 4 | 5 | 31 | 4 | 14 | 6 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 16.83807
Level of Significance 0.1558

Questionnaire No. 4

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 3 | 27 | 12 | 10 | 3 |
| 2 | 18 | 67 | 11 | 28 | 18 |
| 3 | 13 | 51 | 13 | 12 | 15 |
| 4 | 9 | 31 | 7 | 7 | 6 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 15.51230
Level of Significance 0.2146

TABLE 4.--Responses of parents showing relationship of their communities to their perception of metric knowledge: research question 1

Questionnaire No. 1

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 71 | 70 | 16 | 17 | 4 |
| 2 | 8 | 3 | 3 | 1 | 0 |
| 3 | 30 | 25 | 3 | 4 | 3 |
| 4 | 45 | 32 | 5 | 11 | 8 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 15.1727
Level of Significance 0.2321

Questionnaire No. 2

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 22 | 97 | 27 | 20 | 13 |
| 2 | 2 | 9 | 2 | 1 | 1 |
| 3 | 3 | 31 | 9 | 4 | 18 |
| 4 | 13 | 47 | 15 | 11 | 15 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 21.67816
Level of Significance 0.0413

Questionnaire No. 3

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 22 | 89 | 16 | 30 | 22 |
| 2 | 0 | 11 | 4 | 0 | 0 |
| 3 | 2 | 33 | 7 | 8 | 13 |
| 4 | 9 | 39 | 8 | 28 | 17 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 28.5872
Level of Significance 0.0045

Questionnaire No. 4

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 27 | 95 | 16 | 29 | 13 |
| 2 | 2 | 5 | 3 | 4 | 1 |
| 3 | 1 | 30 | 13 | 8 | 13 |
| 4 | 13 | 46 | 11 | 16 | 15 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 24.68599
Level of Significance 0.0154

TABLE 5.--Responses of parents showing relationship of their age to their attitude toward the metric system: research question 3

Questionnaire No. 8

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 4 | 7 | 1 | 0 | 1 |
| 2 | 116 | 84 | 42 | 35 | 19 |
| 3 | 20 | 15 | 5 | 3 | 0 |
| 4 | 0 | 1 | 1 | 0 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 24.26414
Level of Significance 0.0187

Questionnaire No. 9

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 3 | 6 | 1 | 1 | 2 |
| 2 | 91 | 67 | 24 | 64 | 49 |
| 3 | 15 | 9 | 2 | 15 | 2 |
| 4 | 0 | 1 | 0 | 1 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 16.47580
Level of Significance 0.1704

Questionnaire No. 10

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 3 | 4 | 1 | 3 | 2 |
| 2 | 85 | 69 | 28 | 72 | 44 |
| 3 | 15 | 8 | 2 | 17 | 1 |
| 4 | 0 | 1 | 1 | 0 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 17.43663
Level of Significance 0.1339

Questionnaire No. 11

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 6 | 4 | 1 | 2 | 0 |
| 2 | 127 | 55 | 44 | 48 | 24 |
| 3 | 20 | 6 | 7 | 8 | 2 |
| 4 | 0 | 3 | 0 | 0 | 1 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 15.15122
Level of Significance 0.2333

TABLE 5-Continued

Questionnaire No. 12

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 4 | 4 | 0 | 3 | 2 |
| 2 | 116 | 64 | 31 | 47 | 38 |
| 3 | 18 | 8 | 4 | 9 | 3 |
| 4 | 0 | 1 | 1 | 0 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 12.00583
Level of Significance 0.4452

Questionnaire No. 13

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 3 | 5 | 0 | 4 | 1 |
| 2 | 81 | 92 | 29 | 70 | 25 |
| 3 | 15 | 12 | 5 | 10 | 1 |
| 4 | 0 | 1 | 1 | 0 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 16.48225
Level of Significance 0.1701

Questionnaire No. 19

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 3 | 6 | 4 | 0 | 0 |
| 2 | 50 | 128 | 89 | 22 | 9 |
| 3 | 8 | 20 | 13 | 1 | 1 |
| 4 | 0 | 1 | 1 | 0 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 30.79366
Level of Significance 0.0021

Questionnaire No. 20

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 1 | 10 | 1 | 1 |
| 2 | 12 | 25 | 198 | 53 | 9 |
| 3 | 2 | 6 | 24 | 10 | 1 |
| 4 | 0 | 1 | 1 | 0 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 31.89827
Level of Significance 0.0014

TABLE 6.--Responses of parents showing relationship of their education to their attitude toward the metric system: research question 3

Questionnaire No. 8

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 30 | 10 | 13 | 1 | 1 |
| 2 | 57 | 40 | 22 | 14 | 9 |
| 3 | 35 | 35 | 11 | 11 | 10 |
| 4 | 18 | 22 | 3 | 12 | 3 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 30.87727
Level of Significance 0.0021

Questionnaire No. 9

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 20 | 5 | 8 | 12 | 8 |
| 2 | 44 | 37 | 14 | 29 | 17 |
| 3 | 31 | 27 | 4 | 22 | 20 |
| 4 | 14 | 14 | 1 | 18 | 11 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 21.02460
Level of Significance 0.0500

Questionnaire No. 10

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 20 | 4 | 11 | 15 | 5 |
| 2 | 46 | 34 | 14 | 33 | 15 |
| 3 | 25 | 30 | 6 | 23 | 20 |
| 4 | 12 | 14 | 1 | 21 | 10 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 31.76845
Level of Significance 0.0015

Questionnaire No. 11

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 28 | 4 | 9 | 9 | 5 |
| 2 | 54 | 27 | 23 | 27 | 11 |
| 3 | 40 | 24 | 16 | 16 | 8 |
| 4 | 31 | 13 | 5 | 6 | 3 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 13.26119
Level of Significance 0.3503

**TABLE 6-Continued**

Questionnaire No. 12

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 25 | 10 | 8 | 4 | 8 |
| 2 | 51 | 33 | 21 | 21 | 14 |
| 3 | 38 | 26 | 4 | 17 | 18 |
| 4 | 24 | 8 | 3 | 17 | 6 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 25.31583
Level of Significance 0.0134

Questionnaire No. 13

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 23 | 7 | 8 | 13 | 3 |
| 2 | 41 | 46 | 16 | 31 | 8 |
| 3 | 25 | 39 | 7 | 21 | 12 |
| 4 | 10 | 18 | 4 | 19 | 7 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 24.38420
Level of Significance 0.0180

Questionnaire No. 19

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 7 | 26 | 16 | 2 | 4 |
| 2 | 25 | 63 | 35 | 14 | 4 |
| 3 | 20 | 35 | 40 | 4 | 5 |
| 4 | 9 | 31 | 16 | 3 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 16.07785
Level of Significance 0.1133

Questionnaire No. 20

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 2 | 6 | 36 | 8 | 3 |
| 2 | 7 | 14 | 88 | 28 | 5 |
| 3 | 3 | 7 | 70 | 18 | 4 |
| 4 | 2 | 6 | 39 | 10 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 3.07152
Level of Significance 0.9950

**TABLE 7.**--Responses of parents showing relationship of their communities to their attitude toward the metric system: research question 3

Questionnaire No. 8

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 85 | 54 | 23 | 14 | 2 |
| 2 | 8 | 5 | 0 | 2 | 0 |
| 3 | 11 | 19 | 15 | 10 | 10 |
| 4 | 36 | 29 | 11 | 12 | 11 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 42.54948
Level of Significance 0.0000

Questionnaire No. 9

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 61 | 49 | 14 | 45 | 10 |
| 2 | 7 | 3 | 1 | 2 | 2 |
| 3 | 8 | 12 | 6 | 12 | 25 |
| 4 | 33 | 19 | 6 | 22 | 19 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 48.92270
Level of Significance 0.0000

Questionnaire No. 10

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 59 | 49 | 16 | 42 | 13 |
| 2 | 5 | 3 | 3 | 3 | 1 |
| 3 | 9 | 13 | 6 | 21 | 16 |
| 4 | 30 | 17 | 7 | 26 | 20 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 28.08121
Level of Significance 0.0054

Questionnaire No. 11

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 93 | 29 | 25 | 27 | 5 |
| 2 | 5 | 4 | 3 | 2 | 1 |
| 3 | 12 | 16 | 11 | 15 | 11 |
| 4 | 43 | 19 | 14 | 14 | 10 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 31.96355
Level of Significance 0.0014

TABLE 7 -Continued

Questionnaire No. 12

|   | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 79 | 50 | 16 | 27 | 5 |
| 2 | 7 | 4 | 0 | 2 | 2 |
| 3 | 12 | 9 | 9 | 11 | 24 |
| 4 | 40 | 14 | 11 | 19 | 15 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 63.67657
Level of Significance 0.0000

Questionnaire No. 13

|   | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 62 | 59 | 12 | 41 | 4 |
| 2 | 5 | 5 | 3 | 1 | 1 |
| 3 | 9 | 20 | 8 | 17 | 11 |
| 4 | 23 | 26 | 12 | 25 | 14 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 33.65785
Level of Significance 0.0008

Questionnaire No. 19

|   | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 37 | 81 | 52 | 9 | 1 |
| 2 | 4 | 5 | 6 | 0 | 0 |
| 3 | 1 | 25 | 23 | 9 | 7 |
| 4 | 19 | 44 | 26 | 5 | 5 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 36.46635
Level of Significance 0.0003

Questionnaire No. 20

|   | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 11 | 15 | 120 | 32 | 2 |
| 2 | 0 | 3 | 11 | 1 | 0 |
| 3 | 0 | 7 | 32 | 19 | 7 |
| 4 | 3 | 8 | 70 | 12 | 5 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 31.06262
Level of Significance 0.0019

TABLE 8.-Responses of parents showing relationship of their age to greatest problem envisioned regarding metrication: research question 5

Questionnaire No. 14

|   | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 2 | 2 | 6 | 1 | 2 |
| 2 | 42 | 69 | 115 | 52 | 20 |
| 3 | 3 | 11 | 16 | 10 | 3 |
| 4 | 0 | 1 | 1 | 0 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 16.01237
Level of Significance 0.1907

Questionnaire No. 15

|   | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 2 | 1 | 2 | 7 | 1 |
| 2 | 12 | 43 | 68 | 118 | 57 |
| 3 | 3 | 3 | 11 | 21 | 5 |
| 4 | 0 | 1 | 1 | 0 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 13.94768
Level of Significance 0.3041

Questionnaire No. 16

|   | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 2 | 4 | 4 | 2 |
| 2 | 15 | 57 | 68 | 117 | 41 |
| 3 | 4 | 5 | 8 | 22 | 4 |
| 4 | 1 | 0 | 1 | 0 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 14.19896
Level of Significance 0.2882

Questionnaire No. 17

|   | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 3 | 4 | 3 | 2 |
| 2 | 29 | 89 | 103 | 58 | 19 |
| 3 | 4 | 14 | 15 | 9 | 1 |
| 4 | 1 | 0 | 1 | 0 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 17.51004
Level of Significance 0.1314

TABLE 8-Continued

Questionnaire No. 18

|   | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 2 | 3 | 5 | 2 | 1 |
| 2 | 43 | 84 | 62 | 80 | 29 |
| 3 | 5 | 13 | 8 | 14 | 3 |
| 4 | 1 | 0 | 1 | 0 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 13.13364
Level of Significance 0.3574

Questionnaire No. 21

|   | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 2 | 2 | 5 | 3 |
| 2 | 20 | 46 | 69 | 106 | 49 |
| 3 | 5 | 11 | 5 | 17 | 5 |
| 4 | 0 | 1 | 1 | 0 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 11.64372
Level of Significance 0.4747

TABLE 9.-Responses of parents showing relationship of their education to greatest problem envisioned regarding metrication: research question 5

Questionnaire No. 14

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 5 | 17 | 21 | 8 | 4 |
| 2 | 22 | 27 | 64 | 19 | 10 |
| 3 | 9 | 27 | 35 | 24 | 7 |
| 4 | 11 | 12 | 18 | 12 | 7 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 15.75390
Level of Significance 0.2028

Questionnaire No. 15

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 3 | 11 | 14 | 23 | 4 |
| 2 | 7 | 21 | 38 | 56 | 19 |
| 3 | 4 | 11 | 22 | 43 | 23 |
| 4 | 3 | 5 | 8 | 25 | 19 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 20.10188
Level of Significance 0.0652

Questionnaire No. 16

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 3 | 8 | 17 | 20 | 7 |
| 2 | 7 | 31 | 28 | 61 | 15 |
| 3 | 6 | 17 | 24 | 39 | 18 |
| 4 | 5 | 8 | 12 | 23 | 10 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 8.73701
Level of Significance 0.7252

Questionnaire No. 17

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 3 | 18 | 23 | 9 | 2 |
| 2 | 15 | 39 | 48 | 33 | 6 |
| 3 | 13 | 29 | 33 | 19 | 9 |
| 4 | 4 | 20 | 19 | 9 | 8 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 12.89594
Level of Significance 0.3766

TABLE 9 -Continued

Questionnaire No. 18

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 6 | 21 | 20 | 6 | 2 |
| 2 | 19 | 44 | 33 | 36 | 10 |
| 3 | 17 | 26 | 18 | 28 | 14 |
| 4 | 9 | 9 | 5 | 26 | 10 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 38.09451
Level of Significance 0.0001

Questionnaire No. 21

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 4 | 7 | 23 | 17 | 4 |
| 2 | 11 | 26 | 30 | 53 | 15 |
| 3 | 6 | 18 | 16 | 39 | 23 |
| 4 | 5 | 9 | 8 | 19 | 18 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 30.30321
Level of Significance 0.0025

TABLE 10.-Responses of parents showing relationship of their community to greatest problem envisioned regarding metrication: research question 5

Questionnaire No. 14

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 30 | 48 | 72 | 27 | 3 |
| 2 | 3 | 1 | 9 | 1 | 1 |
| 3 | 2 | 12 | 21 | 18 | 12 |
| 4 | 12 | 22 | 36 | 17 | 12 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 39.45692
Level of Significance 0.0001

Questionnaire No. 15

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 9 | 24 | 47 | 81 | 18 |
| 2 | 1 | 2 | 7 | 4 | 1 |
| 3 | 3 | 8 | 7 | 29 | 18 |
| 4 | 4 | 14 | 21 | 33 | 28 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 28.79871
Level of Significance 0.0042

Questionnaire No. 16

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 11 | 32 | 46 | 72 | 18 |
| 2 | 0 | 5 | 6 | 3 | 1 |
| 3 | 1 | 13 | 18 | 22 | 11 |
| 4 | 9 | 14 | 11 | 46 | 20 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 25.75671
Level of Significance 0.0116

Questionnaire No. 17

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 20 | 57 | 66 | 29 | 7 |
| 2 | 0 | 5 | 6 | 3 | 1 |
| 3 | 4 | 19 | 18 | 16 | 8 |
| 4 | 11 | 25 | 33 | 22 | 9 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 13.16989
Level of Significance 0.3568

TABLE 10-Continued

Questionnaire No. 18

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 37 | 58 | 29 | 49 | 6 |
| 2 | 0 | 6 | 6 | 2 | 1 |
| 3 | 4 | 13 | 16 | 18 | 14 |
| 4 | 10 | 23 | 25 | 27 | 15 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 41.91211
Level of Significance 0.0001

Questionnaire No. 21

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 17 | 32 | 31 | 75 | 21 |
| 2 | 1 | 3 | 5 | 4 | 1 |
| 3 | 2 | 8 | 17 | 20 | 16 |
| 4 | 6 | 17 | 24 | 29 | 22 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 19.13066
Level of Significance 0.0854

**TABLE 11.-Responses of parents showing relationship of their age to their willingness to attend workshops, to read and so forth to gain more knowledge in the metric system: research question 7**

Questionnaire No. 5

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 3 | 0 | 2 | 4 | 4 |
| 2 | 95 | 28 | 78 | 29 | 68 |
| 3 | 15 | 5 | 11 | 5 | 6 |
| 4 | 1 | 2 | 0 | 0 | 1 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 17.63068
Level of Significance 0.1274

Questionnaire No. 6

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 3 | 6 | 1 | 0 | 3 |
| 2 | 87 | 83 | 37 | 52 | 39 |
| 3 | 12 | 17 | 7 | 6 | 1 |
| 4 | 1 | 0 | 0 | 1 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 17.45741
Level of Significance 0.1332

Questionnaire No. 7

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 3 | 5 | 5 | 0 | 0 |
| 2 | 115 | 109 | 39 | 12 | 20 |
| 3 | 18 | 14 | 7 | 0 | 2 |
| 4 | 1 | 0 | 2 | 0 | 1 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 17.13226
Level of Significance 0.1447

TABLE 12.-Responses of parents showing relationship of their education to their willingness to attend workshops, to read, and so forth to gain more knowledge in the metric system: research question 7

Questionnaire No. 5

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 14 | 3 | 24 | 6 | 8 |
| 2 | 42 | 14 | 35 | 14 | 35 |
| 3 | 34 | 17 | 20 | 13 | 19 |
| 4 | 24 | 1 | 12 | 6 | 17 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 25.42299
Level of Significance 0.0129

Questionnaire No. 6

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 13 | 20 | 14 | 3 | 5 |
| 2 | 41 | 44 | 14 | 25 | 18 |
| 3 | 32 | 22 | 14 | 18 | 16 |
| 4 | 17 | 20 | 3 | 13 | 7 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 21.73235
Level of Significance 0.0406

Questionnaire No. 7

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 20 | 17 | 10 | 2 | 4 |
| 2 | 51 | 57 | 19 | 5 | 8 |
| 3 | 40 | 34 | 14 | 4 | 9 |
| 4 | 26 | 21 | 10 | 1 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 5.41060
Level of Significance 0.9428

TABLE 13.-Responses of parents showing relationship of their community to their willingness to attend workshops, to read, and so forth to gain more knowledge in the metric system: research question 7

Questionnaire No. 5

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 69 | 17 | 41 | 15 | 36 |
| 2 | 7 | 3 | 3 | 1 | 1 |
| 3 | 9 | 7 | 19 | 10 | 20 |
| 4 | 29 | 8 | 28 | 13 | 22 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 20.75194
Level of Significance 0.0541

Questionnaire No. 6

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 59 | 63 | 23 | 22 | 13 |
| 2 | 7 | 5 | 1 | 2 | 0 |
| 3 | 10 | 13 | 7 | 18 | 16 |
| 4 | 27 | 25 | 14 | 17 | 17 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 34.27332
Level of Significance 0.0006

Questionnaire No. 7

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 83 | 57 | 27 | 4 | 6 |
| 2 | 8 | 3 | 1 | 2 | 1 |
| 3 | 15 | 27 | 15 | 3 | 5 |
| 4 | 31 | 42 | 10 | 3 | 11 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 29.43021
Level of Significance 0.0034

**TABLE 14.-Responses of educators showing relationship of their age to their perception of metric knowledge: research question 2**

Questionnaire No. 1

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 7 | 0 | 3 | 2 |
| 2 | 15 | 55 | 0 | 26 | 11 |
| 3 | 11 | 26 | 0 | 9 | 6 |
| 4 | 0 | 10 | 1 | 3 | 0 |
| 5 | 0 | 1 | 0 | 0 | 0 |

Chi Square Value 21.00815
Level of Significance 0.1782

Questionnaire No. 2

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 8 | 2 | 2 | 1 |
| 2 | 11 | 67 | 8 | 16 | 5 |
| 3 | 4 | 29 | 13 | 5 | 2 |
| 4 | 4 | 4 | 3 | 3 | 0 |
| 5 | 0 | 1 | 0 | 0 | 0 |

Chi Square Value 20.31049
Level of Significance 0.2066

Questionnaire No. 3

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 8 | 1 | 2 | 1 |
| 2 | 4 | 56 | 6 | 28 | 12 |
| 3 | 6 | 21 | 8 | 13 | 5 |
| 4 | 0 | 6 | 3 | 5 | 0 |
| 5 | 0 | 1 | 0 | 0 | 0 |

Chi Square Value 15.49073
Level of Significance 0.4890

Questionnaire No. 4

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 8 | 2 | 2 | 1 |
| 2 | 12 | 56 | 10 | 21 | 8 |
| 3 | 4 | 27 | 13 | 7 | 2 |
| 4 | 3 | 4 | 4 | 3 | 0 |
| 5 | 0 | 1 | 0 | 0 | 0 |

Chi Square Value 15.95679
Level of Significance 0.4560

**TABLE 15.-Responses of educators showing relationship of their education to their perception of metric knowledge: research question 2**

Questionnaire No. 1

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 1 | 0 | 0 | 0 | 0 |
| 4 | 25 | 98 | 1 | 41 | 19 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 8.44524
Level of Significance 0.3912

Questionnaire No. 2

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 1 | 1 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 1 | 0 | 0 | 0 |
| 4 | 19 | 107 | 25 | 26 | 8 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 3.23026
Level of Significance 0.9191

Questionnaire No. 3

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 0 | 1 | 1 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 0 | 0 | 1 |
| 4 | 11 | 92 | 17 | 47 | 17 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 14.61643
Level of Significance 0.0670

Questionnaire No. 4

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 1 | 1 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 1 | 0 | 0 | 0 |
| 4 | 19 | 94 | 28 | 33 | 11 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 3.20761
Level of Significance 0.9207

TABLE 16.-Responses of educators showing relationship of their communities to their perception of metric knowledge: research question 2

Questionnaire No. 1

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 4 | 25 | 0 | 8 | 5 |
| 2 | 2 | 2 | 0 | 1 | 0 |
| 3 | 8 | 33 | 0 | 11 | 0 |
| 4 | 12 | 39 | 1 | 21 | 14 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 16.13939
Level of Significance 0.1849

Questionnaire No. 2

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 4 | 25 | 5 | 7 | 1 |
| 2 | 0 | 2 | 1 | 2 | 0 |
| 3 | 9 | 28 | 6 | 7 | 3 |
| 4 | 6 | 53 | 14 | 10 | 4 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 9.22718
Level of Significance 0.6834

Questionnaire No. 3

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 2 | 18 | 3 | 12 | 7 |
| 2 | 0 | 4 | 0 | 1 | 0 |
| 3 | 4 | 29 | 5 | 11 | 4 |
| 4 | 5 | 40 | 10 | 24 | 7 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 7.42675
Level of Significance 0.8282

Questionnaire No. 4

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 2 | 21 | 3 | 11 | 5 |
| 2 | 0 | 2 | 2 | 1 | 0 |
| 3 | 4 | 27 | 10 | 12 | 0 |
| 4 | 13 | 45 | 14 | 9 | 6 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 19.68047
Level of Significance 0.0734

**TABLE 17.-Responses of educators showing relationship of their age to their attitude toward the metric system: research question 4**

Questionnaire No. 8

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 7 | 2 | 3 | 0 |
| 2 | 33 | 37 | 6 | 20 | 11 |
| 3 | 20 | 20 | 3 | 8 | 2 |
| 4 | 8 | 4 | 0 | 2 | 0 |
| 5 | 0 | 0 | 1 | 0 | 0 |

Chi Square Value 29.27179
Level of Significance 0.0222

Questionnaire No. 9

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 7 | 1 | 4 | 1 |
| 2 | 21 | 30 | 5 | 28 | 23 |
| 3 | 8 | 24 | 1 | 14 | 6 |
| 4 | 3 | 7 | 1 | 3 | 0 |
| 5 | 1 | 0 | 0 | 0 | 0 |

Chi Square Value 19.74742
Level of Significance 0.2318

Questionnaire No. 10

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 7 | 1 | 4 | 1 |
| 2 | 19 | 31 | 5 | 28 | 24 |
| 3 | 8 | 19 | 2 | 18 | 5 |
| 4 | 3 | 4 | 2 | 5 | 0 |
| 5 | 0 | 0 | 1 | 0 | 0 |

Chi Square Value 31.41122
Level of Significance 0.0119

Questionnaire No. 11

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 4 | 4 | 2 | 2 | 1 |
| 2 | 53 | 27 | 8 | 12 | 7 |
| 3 | 28 | 14 | 5 | 5 | 1 |
| 4 | 8 | 2 | 2 | 2 | 0 |
| 5 | 0 | 0 | 1 | 0 | 0 |

Chi Square Value 15.77836
Level of Significance 0.4685

TABLE 17-Continued

Questionnaire No. 12

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 2 | 6 | 2 | 2 | 1 |
| 2 | 24 | 29 | 8 | 22 | 23 |
| 3 | 19 | 14 | 4 | 14 | 2 |
| 4 | 5 | 8 | 0 | 1 | 0 |
| 5 | 0 | 0 | 1 | 0 | 0 |

Chi Square Value 34.89676
Level of Significance 0.004

Questionnaire No. 13

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 5 | 1 | 5 | 1 |
| 2 | 20 | 34 | 2 | 31 | 20 |
| 3 | 8 | 21 | 5 | 18 | 1 |
| 4 | 1 | 8 | 2 | 3 | 0 |
| 5 | 0 | 1 | 0 | 0 | 0 |

Chi Square Value 25.45830
Level of Significance 0.0621

Questionnaire No. 19

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 4 | 6 | 1 | 1 |
| 2 | 12 | 52 | 38 | 5 | 0 |
| 3 | 13 | 24 | 13 | 2 | 0 |
| 4 | 5 | 4 | 3 | 2 | 0 |
| 5 | 0 | 1 | 0 | 0 | 0 |

Chi Square Value 29.14374
Level of Significance 0.0230

Questionnaire No. 20

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 2 | 6 | 5 | 0 |
| 2 | 5 | 23 | 52 | 21 | 6 |
| 3 | 7 | 11 | 22 | 11 | 1 |
| 4 | 2 | 4 | 4 | 4 | 0 |
| 5 | 0 | 0 | 1 | 0 | 0 |

Chi Square Value 13.07245
Level of Significance 0.6675

**TABLE 18**-Responses of educators showing relationship of their education to their attitude toward the metric system: research question 4

Questionnaire No. 8

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 2 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 1 | 0 | 0 | 0 | 0 |
| 4 | 59 | 68 | 12 | 33 | 13 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 6.19563
Level of Significance 0.6253

Questionnaire No. 9

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 1 | 0 | 0 | 0 |
| 4 | 32 | 66 | 8 | 49 | 30 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 4.03746
Level of Significance 0.8537

Questionnaire No. 10

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 1 | 0 | 0 | 0 | 0 |
| 4 | 28 | 60 | 11 | 55 | 30 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 7.98604
Level of Significance 0.4348

Questionnaire No. 11

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 1 | 0 | 0 | 0 |
| 4 | 92 | 45 | 18 | 21 | 9 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 4.05951
Level of Significance 0.8517

TABLE 18-Continued

Questionnaire No. 12

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 1 | 0 | 0 | 0 | 0 |
| 4 | 48 | 56 | 15 | 39 | 26 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 4.30057
Level of Significance 0.8290

Questionnaire No. 13

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 2 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 1 | 0 | 0 | 0 |
| 4 | 27 | 68 | 10 | 57 | 22 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 12.71268
Level of Significance 0.1221

Questionnaire No. 19

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 1 | 1 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 1 | 0 | 0 | 0 |
| 4 | 31 | 83 | 59 | 10 | 1 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 1.87418
Level of Significance 0.9846

Questionnaire No. 20

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 1 | 1 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 1 | 0 | 0 | 0 |
| 4 | 14 | 38 | 84 | 41 | 7 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 5.17717
Level of Significance 0.7385

**TABLE 19.-Responses of educators showing relationship of their communities to their attitude toward the metric system: research question 4**

Questionnaire No. 8

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 13 | 16 | 2 | 9 | 2 |
| 2 | 1 | 3 | 1 | 0 | 0 |
| 3 | 21 | 13 | 5 | 10 | 4 |
| 4 | 26 | 36 | 4 | 14 | 7 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 9.74061
Level of Significance 0.6387

Questionnaire No. 9

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 5 | 19 | 0 | 13 | 5 |
| 2 | 0 | 2 | 1 | 1 | 1 |
| 3 | 11 | 19 | 2 | 12 | 9 |
| 4 | 16 | 28 | 5 | 23 | 15 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 9.81839
Level of Significance 0.6319

Questionnaire No. 10

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 3 | 17 | 1 | 16 | 5 |
| 2 | 0 | 1 | 1 | 2 | 1 |
| 3 | 10 | 16 | 4 | 14 | 9 |
| 4 | 16 | 27 | 5 | 23 | 15 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 9.79269
Level of Significance 0.6341

Questionnaire No. 11

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 14 | 14 | 5 | 6 | 3 |
| 2 | 1 | 1 | 1 | 2 | 0 |
| 3 | 33 | 9 | 4 | 5 | 2 |
| 4 | 44 | 23 | 8 | 8 | 4 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 13.91252
Level of Significance 0.3063

**TABLE 19-Continued**

Questionnaire No. 12

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 7 | 13 | 2 | 15 | 5 |
| 2 | 0 | 1 | 1 | 3 | 0 |
| 3 | 15 | 15 | 6 | 7 | 10 |
| 4 | 27 | 28 | 6 | 14 | 11 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 18.61256
Level of Significance 0.0983

Questionnaire No. 13

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 2 | 19 | 1 | 16 | 4 |
| 2 | 0 | 2 | 1 | 1 | 1 |
| 3 | 8 | 15 | 5 | 20 | 4 |
| 4 | 18 | 33 | 3 | 20 | 13 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 17.89185
Level of Significance 0.1190

Questionnaire No. 19

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 5 | 21 | 12 | 3 | 1 |
| 2 | 1 | 2 | 2 | 0 | 0 |
| 3 | 8 | 23 | 19 | 3 | 0 |
| 4 | 17 | 38 | 27 | 4 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 6.01622
Level of Significance 0.9153

Questionnaire No. 20

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 2 | 11 | 20 | 8 | 1 |
| 2 | 0 | 0 | 2 | 3 | 0 |
| 3 | 5 | 9 | 28 | 9 | 2 |
| 4 | 7 | 19 | 35 | 21 | 4 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 9.13704
Level of Significance 0.6912

**TABLE 20 .-Responses of educators showing relationship of their age to greatest problem envisioned regarding metrication: research question 6**

Questionnaire No. 14

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 3 | 6 | 4 | 0 |
| 2 | 7 | 24 | 43 | 24 | 9 |
| 3 | 5 | 10 | 22 | 10 | 4 |
| 4 | 0 | 5 | 8 | 1 | 0 |
| 5 | 0 | 0 | 1 | 0 | 0 |

Chi Square Value 10.38240
Level of Significance 0.8459

Questionnaire No. 15

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 2 | 2 | 9 | 0 |
| 2 | 2 | 7 | 24 | 48 | 26 |
| 3 | [illegible] | 8 | 8 | 26 | 8 |
| 4 | 0 | 4 | 3 | 5 | 2 |
| 5 | 0 | 0 | 1 | 0 | 0 |

Chi Square Value 21.11067
Level of Significance 0.1743

Questionnaire No. 16

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 1 | 5 | 4 | 3 |
| 2 | 1 | 17 | 17 | 51 | 21 |
| 3 | 4 | 10 | 8 | 24 | 6 |
| 4 | 0 | 4 | 1 | 6 | 3 |
| 5 | 0 | 0 | 0 | 1 | 0 |

Chi Square Value 16.98395
Level of Significance 0.3866

Questionnaire No. 17

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 1 | 6 | 6 | 0 |
| 2 | 5 | 20 | 42 | 26 | 14 |
| 3 | 5 | 10 | 17 | 16 | 3 |
| 4 | 1 | 5 | 4 | 1 | 3 |
| 5 | 0 | 0 | 1 | 0 | 0 |

Chi Square Value 16.90498
Level of Significance 0.3918

TABLE 20-Continued

Questionnaire No. 18

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 0 | 1 | 10 | 2 |
| 2 | 7 | 19 | 19 | 39 | 22 |
| 3 | 8 | 6 | 8 | 25 | 6 |
| 4 | 3 | 1 | 4 | 3 | 3 |
| 5 | 0 | 1 | 0 | 0 | 0 |

Chi Square Value 25.66370
Level of Significance 0.0589

Questionnaire No. 21

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 0 | 2 | 8 | 3 |
| 2 | 2 | 7 | 15 | 61 | 22 |
| 3 | 4 | 9 | 6 | 28 | 5 |
| 4 | 1 | 3 | 2 | 6 | 2 |
| 5 | 0 | 1 | 0 | 0 | 0 |

Chi Square Value 22.75349
Level of Significance 0.1205

TABLE 21.-Responses of educators showing relationship of their education to greatest problem envisioned regarding metrication: research question 6

Questionnaire No. 14

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 0 | 1 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 1 | 0 | 0 | 0 | 0 |
| 4 | 10 | 42 | 79 | 39 | 13 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 21.71474
Level of Significance 0.0055

Questionnaire No. 15

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 0 | 2 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 0 | 1 | 0 | 0 |
| 4 | 5 | 21 | 35 | 88 | 36 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 12.03413
Level of Significance 0.1497

Questionnaire No. 16

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 1 | 1 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 1 | 0 | 0 | 0 |
| 4 | 5 | 30 | 30 | 86 | 33 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 8.89266
Level of Significance 0.3514

Questionnaire No. 17

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 1 | 1 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 1 | 0 | 0 | 0 |
| 4 | 11 | 34 | 69 | 49 | 20 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 6.15684
Level of Significance 0.6297

TABLE 21-Continued

Questionnaire No. 18

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 1 | 0 | 0 | 0 |
| 4 | 17 | 25 | 32 | 77 | 33 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 12.74144
Level of Significance 0.1211

Questionnaire No. 21

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 0 | 1 | 1 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 1 | 0 | 0 | 0 |
| 4 | 7 | 18 | 24 | 103 | 32 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 14.9599
Level of Significance 0.0599

TABLE 22-Responses of educators showing relationship of their community to greatest problem envisioned regarding metrication: research question 6

Questionnaire No. 14

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 2 | 11 | 16 | 10 | 3 |
| 2 | 0 | 1 | 3 | 1 | 0 |
| 3 | 4 | 9 | 28 | 11 | 1 |
| 4 | 6 | 21 | 32 | 17 | 9 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 8.22815
Level of Significance 0.7671

Questionnaire No. 15

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 5 | 6 | 21 | 9 |
| 2 | 0 | 1 | 1 | 1 | 2 |
| 3 | 3 | 4 | 13 | 26 | 7 |
| 4 | 1 | 10 | 18 | 40 | 18 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 8.13952
Level of Significance 0.7741

Questionnaire No. 16

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 6 | 7 | 18 | 10 |
| 2 | 0 | 0 | 1 | 3 | 1 |
| 3 | 4 | 4 | 8 | 30 | 7 |
| 4 | 0 | 22 | 14 | 35 | 15 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 18.2710
Level of Significance 0.1077

Questionnaire No. 17

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 3 | 4 | 17 | 12 | 6 |
| 2 | 0 | 1 | 4 | 0 | 0 |
| 3 | 4 | 9 | 18 | 18 | 4 |
| 4 | 4 | 21 | 31 | 19 | 10 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 11.76125
Level of Significance 0.4650

TABLE 22-Continued

Questionnaire No. 18

|   | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 4 | 3 | 8 | 19 | 7 |
| 2 | 0 | 0 | 2 | 3 | 0 |
| 3 | 4 | 7 | 14 | 23 | 5 |
| 4 | 10 | 16 | 8 | 32 | 21 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 17.88269
Level of Significance 0.1193

Questionnaire No. 21

|   | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 3 | 4 | 3 | 24 | 8 |
| 2 | 0 | 0 | 1 | 3 | 1 |
| 3 | 2 | 4 | 10 | 30 | 7 |
| 4 | 2 | 11 | 11 | 46 | 16 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 6.78980
Level of Significance 0.8712

**TABLE 23.--Responses of educators showing relationship of their age to their willingness to attend workshops, to read, and so forth to gain more knowledge in the metric system: research question 7**

Questionnaire No. 5

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 2 | 1 | 1 | 2 | 7 |
| 2 | 27 | 2 | 35 | 14 | 29 |
| 3 | 24 | 2 | 14 | 1 | 12 |
| 4 | 7 | 1 | 2 | 0 | 4 |
| 5 | 0 | 0 | 1 | 0 | 0 |

Chi Square Value 25.9440
Level of Significance 0.0548

Questionnaire No. 6

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 5 | 5 | 2 | 1 | 0 |
| 2 | 30 | 41 | 16 | 12 | 6 |
| 3 | 28 | 18 | 3 | 1 | 1 |
| 4 | 5 | 3 | 4 | 2 | 0 |
| 5 | 1 | 0 | 0 | 0 | 0 |

Chi Square Value 20.48155
Level of Significance 0.1993

Questionnaire No. 7

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 3 | 8 | 1 | 1 | 0 |
| 2 | 38 | 51 | 13 | 2 | 1 |
| 3 | 24 | 19 | 5 | 1 | 1 |
| 4 | 6 | 8 | 0 | 0 | 0 |
| 5 | 1 | 0 | 0 | 0 | 0 |

Chi Square Value 10.28661
Level of Significance 0.8512

TABLE 24.-Responses of educators showing relationship of their education to their willing ness to attend workshops, to read, and so forth to gain more knowledge in the metric system: research question 7

Questionnaire No. 5

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 2 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 1 | 0 | 0 | 0 | 0 |
| 4 | 57 | 6 | 53 | 17 | 52 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 6.50378
Level of Significance 0.5910

Questionnaire No. 6

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 1 | 1 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 1 | 0 | 0 | 0 |
| 4 | 68 | 65 | 25 | 16 | 7 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 2.47843
Level of Significance 0.9627

Questionnaire No. 7

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 2 | 0 | 0 | 0 | 0 |
| 2 | 0 | 0 | 0 | 0 | 0 |
| 3 | 0 | 1 | 0 | 0 | 0 |
| 4 | 70 | 85 | 19 | 4 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 4.22954
Level of Significance 0.8358

**TABLE 25.-Responses of educators showing relationship of their community to their willingness to attend workshop, to read, and so forth to gain more knowledge in the metric system: research question 7**

Questionnaire No. 5

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 13 | 2 | 8 | 7 | 12 |
| 2 | 0 | 0 | 0 | 1 | 4 |
| 3 | 13 | 3 | 17 | 3 | 17 |
| 4 | 33 | 1 | 28 | 6 | 19 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 20.38458
Level of Significance 0.0602

Questionnaire No. 6

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 17 | 15 | 6 | 3 | 1 |
| 2 | 2 | 1 | 1 | 1 | 0 |
| 3 | 10 | 27 | 7 | 4 | 4 |
| 4 | 39 | 24 | 11 | 8 | 2 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 15.83815
Level of Significance 0.1988

Questionnaire No. 7

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 19 | 18 | 3 | 1 | 1 |
| 2 | 0 | 3 | 2 | 0 | 0 |
| 3 | 16 | 30 | 4 | 1 | 1 |
| 4 | 36 | 35 | 10 | 2 | 0 |
| 5 | 0 | 0 | 0 | 0 | 0 |

Chi Square Value 12.94722
Level of Significance 0.3729

TABLE 26.-The combined frequencies, and adjusted frequencies (percents) of responses of parents and educators for research questions 1 and 2

Questionnaire No. 1

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 181 | 229 | 28 | 74 | 34 |
| A.F. | 33.2 | 41.9 | 5.1 | 13.6 | 6.2 |

Questionnaire No. 2

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 59 | 293 | 79 | 62 | 55 |
| A.F. | 10.8 | 53.5 | 14.4 | 11.3 | 10.0 |

Questionnaire No. 3

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 44 | 264 | 53 | 114 | 70 |
| A.F. | 8.1 | 48.4 | 9.7 | 20.9 | 12.8 |

Questionnaire No. 4

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 62 | 272 | 72 | 90 | 53 |
| A.F. | 11.3 | 49.5 | 13.1 | 16.4 | 9.7 |

TABLE 27.-The combined frequencies, and adjusted frequencies (percents) of responses of parents and educators for research questions 3 and 4.

Questionnaire No. 8

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 202 | 175 | 61 | 71 | 36 |
| A.F. | 37.1 | 32.1 | 11.2 | 13.0 | 6.6 |

Questionnaire No. 9

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 142 | 151 | 35 | 130 | 86 |
| A.F. | 26.1 | 27.8 | 6.4 | 23.9 | 15.8 |

Questionnaire No. 10

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 133 | 143 | 43 | 147 | 80 |
| A.F. | 24.4 | 26.2 | 7.9 | 26.9 | 14.7 |

Questionnaire No. 11

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 246 | 115 | 71 | 79 | 36 |
| A.F. | 45.0 | 21.0 | 13.0 | 14.4 | 6.6 |

Questionnaire No. 12

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 188 | 134 | 51 | 98 | 72 |
| A.F. | 34.6 | 24.7 | 9.4 | 18.0 | 13.3 |

Questionnaire No. 13

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 128 | 179 | 45 | 141 | 52 |
| A.F. | 23.5 | 32.8 | 8.3 | 25.9 | 9.5 |

Questionnaire No. 19

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 92 | 240 | 167 | 33 | 14 |
| A.F. | 16.8 | 44.0 | 30.6 | 6.0 | 2.6 |

Questionnaire No. 20

| | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 28 | 73 | 318 | 105 | 21 |
| A.F. | 5.4 | 13.4 | 58.3 | 19.0 | 3.9 |

TABLE 28.-The combined frequencies, and adjusted frequencies (percents) of responses of parents and educators for research questions 5 and 6

Questionnaire No. 14

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 59 | 125 | 218 | 102 | 41 |
| A.F. | 10.8 | 22.9 | 40.0 | 18.7 | 7.5 |

Questionnaire No. 15

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 22 | 69 | 120 | 235 | 101 |
| A.F. | 4.0 | 12.6 | 21.9 | 43.0 | 18.5 |

Questionnaire No. 16

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 26 | 96 | 112 | 229 | 83 |
| A.F. | 4.8 | 17.6 | 20.5 | 41.9 | 15.2 |

Questionnaire No. 17

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 46 | 142 | 193 | 119 | 45 |
| A.F. | 8.4 | 26.1 | 35.4 | 21.8 | 8.3 |

Questionnaire No. 18

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 69 | 127 | 108 | 173 | 69 |
| A.F. | 12.6 | 23.3 | 19.8 | 31.7 | 12.6 |

Questionnaire No. 21

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 33 | 80 | 102 | 231 | 92 |
| A.F. | 6.1 | 14.9 | 19.0 | 42.9 | 17.1 |

TABLE 29.-The combined frequencies, and adjusted frequencies (percents) of responses of parents and educators for research question 7

Questionnaire No. 5

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 174 | 41 | 144 | 56 | 131 |
| A.F. | 31.9 | 7.5 | 26.4 | 10.3 | 24.0 |

Questionnaire No. 6

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 172 | 173 | 70 | 75 | 53 |
| A.F. | 31.7 | 31.9 | 12.9 | 13.8 | 9.8 |

Questionnaire No. 7

|  | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| F. | 209 | 215 | 72 | 16 | 25 |
| A.F. | 38.9 | 40.0 | 13.4 | 3.0 | 4.7 |

# APPENDIX C

October 1978

Dear Parent:

I am making a study of the needs and attitudes of parents and teachers toward the metric system.

This survey is being conducted in both the Rock Island School District 41, and the Erie School District 1. Comparisons of urban and rural districts will be made.

Besides being of value to the two school districts involved, this study is also considered to be of great importance to the State of Illinois.

You have been randomly selected as one of the parents to be surveyed. Will you please take a few minutes of your time and complete the attached questionnaire?

When completed, please have your child return it to his or her teacher. It is important that all questionnaires be returned as soon as possible.

Thank you for your help.

Yours very truly,

Betty Lou Whitted

Betty Lou Whitted

BLW
Att.

October 1978

Dear Fellow Teacher:

Currently I am working on my doctoral degree and am conducting a survey of the needs and attitudes of parents and teachers toward the metric system.

This survey is being taken in both the Rock Island School District 41, and Erie School District 1 to compare urban and rural populations. All teachers in classes K-5 in both districts are being surveyed.

Besides being of significance to the two school districts, this study is also considered to be of great importance to the State of Illinois.

I am asking you to take a few moments of your time to complete the attached questionnaire and return it to me in the enclosed self-addressed envelope.

I need not tell you the importance of receiving all questionnaires sent out. Please help me in this endeavor.

Thank you for your cooperation.

Yours very truly,

Betty Lou Whitted

Betty Lou Whitted

BLW
Att.

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
NATIONAL INSTITUTE OF EDUCATION
WASHINGTON, D.C. 20208

August 25, 1978

Mrs. Betty Lou Whitted
2215 - 20½ Avenue
Rock Island, Illinois 61201

Dear Mrs. Whitted:

Enclosed please find a copy of the Institute's most recently completed metric research project. Hopefully it will be of assistance to you in formulating final plans for your study, "A Comparative Survey of Parents' and Educators' Attitudes Toward the Metric System of Measurement."

I was pleased that you were able to visit the Institute during your visit to Washington, D.C., and wish you great success in your work. Your completed study will most certainly be of significant value to those school systems in which you will be collecting data, and the preliminary plans show promise of being of value to broader metric interests as well.

Again, the best of luck.

Sincerely,

Kent Sullivan

Kent Sullivan
Research Associate

Enclosure

**STATE BOARD OF EDUCATION**
**ILLINOIS OFFICE OF EDUCATION**

**Joseph M. Cronin**
**State Superintendent of Education**

August 24, 1978

Ms. Betty Lou Whitted
2215 20 1/2 Avenue
Rock Island, Illinois 61201

Dear Ms. Whitted:

After reading your dissertation proposal, I feel that the survey that you intend to perform will be of great importance to the metric effort in the state.

Enclosed is some information that I think will be useful to you. If I can be of further assistance, please contact me.

Sincerely,

Wendell A. Meeks

Wendell A. Meeks
Educational Consultant
Mathematics/Metrics
Program Planning and Development

BC/4/D

Enclosures

100 North First Street
Springfield, Illinois 62777
217/782-4321

188 West Randolph
Chicago, Illinois 60601
312/793-2220

State Office Building
601 North 18th
Mt. Vernon, Illinois 62864

Post Office Box 825
DeKalb, Illinois 60115
815/753-0261

3 Henson Place
Champaign, Illinois 61820
217/333-6770

# Erie Community Unit School District No. 1

Erie, Illinois 61250

| | | | |
|---|---|---|---|
| ADMINISTRATION CENTER | 309/659-2239 | ERIE ELEMENTARY SCHOOL | 309/659-2491 |
| ERIE HIGH SCHOOL | 309/659-2401 | FENTON ELEMENTARY SCHOOL | 815/778-4588 |
| ERIE JUNIOR HIGH SCHOOL | 309/659-2481 | PORTLAND ELEMENTARY SCHOOL | 815/537-2768 |

October 30, 1978

Administrative Memo #27

To: Betty Whitted

Re: Survey

From: Gene R. Cusic, Supt.

Your request to conduct a metric survey for your doctoral thesis, as requested, has been approved. I would like to see the results of your work when completed. Good luck in this ambitious endeavor.

Gene R. Cusic

**ROCK ISLAND PUBLIC SCHOOLS**

James A. Hopson, Superintendent

Administrative Center
541 Twenty-first Street
Rock Island, Illinois 61201
(309) 794-0131

September 25, 1978

Mrs. Betty Whitted
2215 20½ Avenue
Rock Island, Illinois 61201

Dear Mrs. Whitted:

This is to confirm our recent telephone conversation granting you permission to do a metric study in the Rock Island District #41 School District.

We wish you much success in this study.

Sincerely,

James A. Hopson

James A. Hopson

JAH:js

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# VITA

## Betty Lou Whitted

**Personal:**

Born in Rock Island, Illinois
Married Merton M. Whitted in 1948-moved to Geneseo, Illinois-lived there twenty-five years. Married thirty-one years. Presently living in Rock Island, Illinois. One son, Michael John, graduate of Loras College, Dubuque, Iowa.

**School:**

St. Joseph High School, Rock Island, Il. 1941.
Marycrest College, Davenport, Iowa B.A. 1969.
Marycrest College, Davenport, Iowa M.A. 1972.
Walden University Ph.D. 1979.

**Employment:**

1941-1948 secretary to Superintendent of the East Moline State Hospital and Personnel Director.
1964-present, elementary school teacher.

**Community Service:**

Produced the first two Music Festivals in Geneseo, Illinois. These were two day affairs and attended by thousands.
While president of the Womens' Club in Geneseo won Sears state award for Community Service.

**Publications and Presentations:**

East Moline State Hospital - two manuals: employees, "Handbook for Employees," and "East Moline State Hospital" for patients' families and friends.

While husband, Merton, was Mayor of Geneseo (five terms) wrote news column "City Chatter" monthly for Geneseo Republic.

Published an article in the Illinois Mathematics Teacher, publication of the Ill. Council of Teachers of Mathematics.

Gave numerous presentations throughout the northern part of Illinois and Iowa for teachers' institutes and Title I programs on individualizing math programs and on remedial math.